BUILDING TUNE-UP ACCELERATOR



Tune-Up Accelerator Provider Training February 13, 2018

SMART BUILDINGS CENTER

WELCOME & INTRODUCTIONS



Program Partners













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Training Agenda at a Glance

- Welcome & Introductions
- Seattle Building Tune-Ups Requirement
- Building Tune-Up Accelerator Program
- Asset Score
- Diagnostic Tool Lending Library
- Building Re-Tuning
- Building Renewal
- Utility Incentives

Definitions: Tune-Ups & Re-Tuning

Seattle Building Tune-Ups Mandate

- Seattle policy requiring owners of non-residential buildings 50K SF or greater to tune-up their buildings.
- Specific required
 O&M actions to
 assess and correct.
- No incentives.

Seattle Tune-Up Accelerator Program

- Voluntary, timelimited alternative compliance path to meet Building Tune-Ups mandate.
- Buildings 100K SF or less are eligible.
- Specific required
 O&M actions to
 assess and correct.
- Incentives available.

PNNL Building Re-Tuning™

- Method & training created by PNNL to detect and correct O&M problems in buildings.
- Methods and O&M actions overlap with Seattle Tune-Ups programs.



Tune-Up Accelerator: Provider Training

Seattle Building Tune-Ups Policy



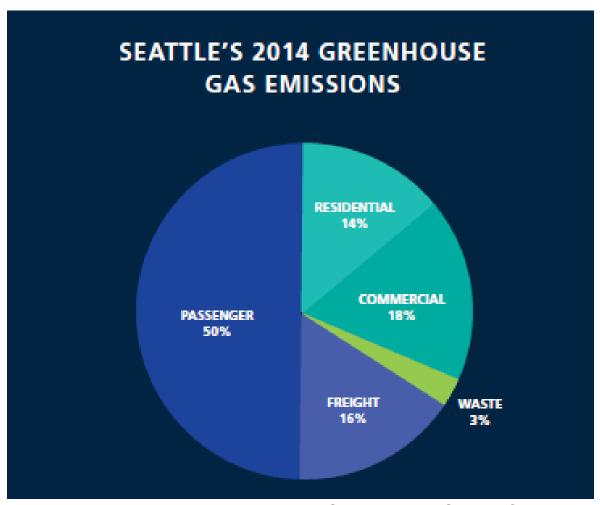
What is a Tune-Up?

- RCx "lite"
- Operational improvements, not capital
- Generate energy and water savings through low to no-cost measures
- Currently a best practice for managing an energy efficient building





Buildings are a significant contributor to carbon pollution



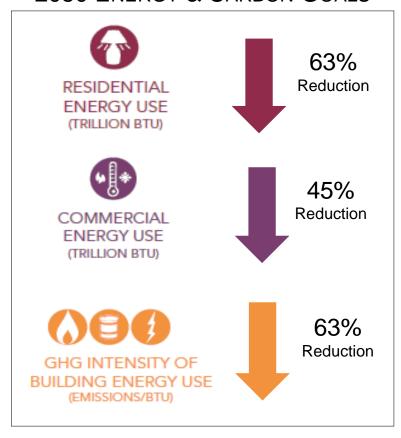
Source: 2014 Seattle Community GHG Inventory



Seattle has a bold mandate to achieve carbon goals



2050 ENERGY & CARBON GOALS





We have work to do...

- Wanted immediate savings for us and you
- A cost-effective approach (not a document on a shelf with no action)
- Practical, current best practice

Reduce energy use in homes by 20% and commercial buildings by 10% by 2030 SINCE 2008, WE'VE SAVED IN HOMES IN COMMERCIAL BUILDINGS



Who does this mandate apply to? Who is excluded?



All non-residential buildings and commercial spaces > 50k SF (excluding parking)
Tune-up every 5 years

Excluded from mandate

- Single-family residential buildings
- Multifamily residential buildings
- Mixed-use buildings < 50k SF of nonresidential space
- Buildings used primarily for manufacturing or industrial uses
- Buildings previously exempted from the annual benchmarking requirement



Who can conduct the Tune-Ups?

Tune-Up Specialists must meet following qualifications

At least seven years experience *plus* one of the following:

- Professional Engineer
- Certified Energy Manager
- Sexisting Building Commissioning Professional
- Certified Commissioning Professional
- Commissioning Authority certification
- S Level II Building Operator Certification
- Sachelor in Sustainable Building Science Technology



TUNE-UP SCHEDULE

Ongoing, every five years

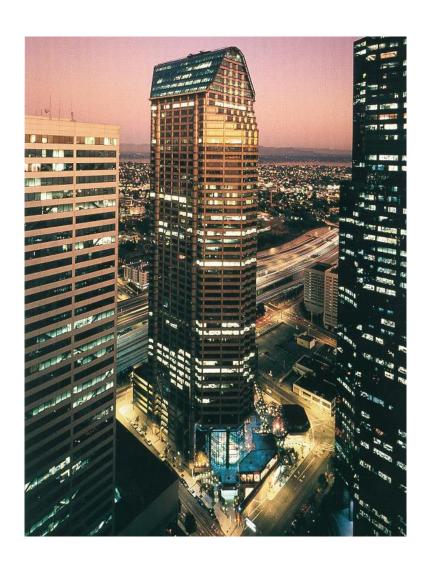
BUILDING SIZE*	DUE
200,000+ SF	March 1, 2019
100,000-199,999 SF	October 1, 2019
70,000-99,999 SF	October 1, 2020
50,000-69,999 SF	October 1, 2021

^{*} Excluding parking

Leading by Example

All municipal buildings must meet Building Tune-Ups deadlines one year ahead of privately-owned buildings.

Municipal Tune-Ups will save the City money and help us meet our energy reduction goals.





The Tune-Up Process:

- An ASSESSMENT of building systems to identify operational or maintenance issues;
- RECOMMENDATIONS to building owner;
- CORRECTIONS to operational and maintenance issues identified in the inspection;
- VERIFICATION that corrections were made; and
- Submittal of a SUMMARY REPORT to OSE that notes the issues identified and actions taken.

The ASSESSMENT (by Tune-Up Specialist) includes:

- Review and verify ENERGY STAR Portfolio Manager account information.
- Review and evaluate monthly energy and water billing data.
- Documentation of basic building characteristics: HVAC systems, lighting, occupancy, space types, electric vehicle charging, other high use systems.
- On-site assessment of building systems.



Site Assessment: Energy & Water

(by Tune-Up Specialist)

Operational Protocols, Calibration, and Sequencing, e.g.

- Review HVAC equipment schedules
- Verify irrigation rain sensors are calibrated and functioning properly

Maintenance, Cleaning and Repair, e.g.

- Verify HVAC equipment is clean and adequately maintained
- Check water flow fixtures

Tune-Up Specialist Recommendations to Owner

- Identifies "Corrective Actions" required by Seattle Tune-Ups mandate, and
- Identifies voluntary measures included in the mandate.
- May also include recommendations for additional opportunities (other O&M, capital energy measures, etc.)

Format of report to owner per owner-provider contract and standard provider protocols.



Corrections: Energy & Water (by Tune-Up Specialist, Contractor or Facilities Staff)

Operational Protocols, Calibration, and Sequencing, e.g.

- Set HVAC schedules to optimize for actual building occupancy patterns.
- Adjust calibrate or repair, as appropriate

Maintenance, Cleaning and Repair, e.g.

- Clean HVAC equipment where adversely impacting system performance
- Recommend low flow fixture of aerator replacements.



Additional measures requested by Owner



Verification & Report Submittal

The Tune-Up Specialist

- Verifies that corrective actions have been implemented, and
- Completes the Seattle Tune-Up Summary Report.
- Both Owner and Specialist confirm that report is accurate.
- Report is submitted by either the Owner or the Specialist on the Owner's behalf.



Building Tune-Ups Summary Report

C2. Parking garage area (per Portfolio Manager) if applicable

C. BUILDING CHARACTERISTICS

C3. Year built

C1. Total nonresidential gross floor area (excluding parking area)

. Year and description of any major building	g remodels (e.g. per	mitted as s	ubstantial alteration, major change of	ilding use or function that would	alter energy use)
:. Primary building use (per Portfolio Manag	as)				
. Frimary building use (per Fortfolio Manag	er)				
. Was the building originally designed for th	ne current use?		Q'		
Overall building occupancy					
Described with the best of the state of the left of the state of the s	D - L	\mathcal{N}	6- A H		
3. Does the building have electric vehicle (E)	V) charging stations	5:	Cg. Are they separately metered?		
Does the building have on-site renewab	les/self-generated	enerov?	C12. Average annual generation (if know	vn) in bwh	
1. Boes the building have on site renewab	resysem generated		C12: / Welage dillion generation (il know	VII) III KWII	
3. Provide information for the five most en	ergy intensive space	e uses in the	building.		
Space Use (Up to five largest energy users)	Square Feet		Primary Heating System		Primary Cooling
		Туре		Туре	
		Age		Age	
		Condition		Condition	
	1	l -	I	l -	

Building Tune-Ups Summary Report

Detailed Findings & Corrections

Assessment Element

Corrective Action

Tune-Up Finding

Status of Tune-Up Correction

Corrective
Action
Description

End Condition

- 1. HVAC
- 2. Lighting
- 3. Domestic Hot Water
- 4. Water Usage
- 5. Envelope







Alternative Compliance Pathways

High Performance

- Certified ENERGY STAR Score
- LEED Gold for O&M
- Living Building, Petal, or Net Zero Energy
- Low Energy Consumption

Equivalent Process

- Ongoing Commissioning (OCx)
- Completed RCx
- Implemented ASHRAE L2 Audit Recs
- Reduced EUI
- New Construction or Substantial Alteration

Tune-Up Accelerator

- Program for buildings 100K SF or less
- Funding sunsets after 2018

Under Limited Circumstances

Single-Round Waiver

- Demolition
- Major Renovation
- Financial Distress

Extension Requests

- Change of Ownership
- High Vacancy Rate
- Existing Mechanical Improvements
- Demonstrated 15% EUI Reduction



Tune-Up Accelerator Program Overview



PRESENTED BY:

Nicole Ballinger

Tune-Accelerator Program Manager Seattle Office of Sustainability & Environment nicole.ballinger@seattle.gov | 206-233-7184



Presentation Outline

TIME	TOPICS
10 min	Accelerator Background & Goals
5 min	Market Overview
15 min	Accelerator Overview – 3 Phases
5 min	Program Evaluation – M & V
10 min	Tune-Up Accelerator Summary Report Demo
10 min	Q & A

ACCELERATOR BACKGROUND & GOALS



Tune-Up Accelerator Program Goals

- 1. Accelerate tune-ups in small-medium buildings
- 2. Advance market expertise to support tune-ups
- Generate voluntary market action towards even greater savings
- Ensure that the mandate is effective for this market sector



Accelerator DOE Support

- Awarded to City of Seattle in 2016
- Small-Medium Commercial Buildings (approx. 100K SF or less)
- Implementing through September 2019



Program Partners













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Program Partner Roles

PARTNER	PRIMARY ROLES
Seattle OSE	Program Management, Enrollment, Coordination w/ Building Tune-Ups requirement, Reporting to DOE
SBC	Provider Training & Curricula, Tool Lending Library, Project Tracking, Help Desk
PNNL	Building Re-Tuning Training, Asset Score Support & Research on energy-savings from tune-ups
City Light	Tune-Up and Energy Conservation Incentives
UW IDL	Building Renewal Support, Spark Tool
US DOE EERE	Federal funding and project oversight

Accelerator Energy & Cost Savings Goals

✓ Average 20% energy savings across at least 100 buildings or tenant spaces

√ Total Savings 99.7 Million kBtu/year

√\$1.5 Million annual cost savings

Getting to 20% Average Savings

A.	Basic Tune-Up Tune-Up Meets BTU Requirements	+/- 10% Savings (35-40 Buildings)
В.	Tune-Up Plus Meets Requirement + Energy Conservation Measures	+/- 20% Savings (+35-40 Buildings)
C.	Building Renewal Technical Support for Buildings Pursuing Deeper Upgrades	+/- 35% Savings (+20-30 Buildings)

SMALL – MEDIUM BUILDINGS SEATTLE MARKET OVERVIEW & ENROLLMENT UPDATE

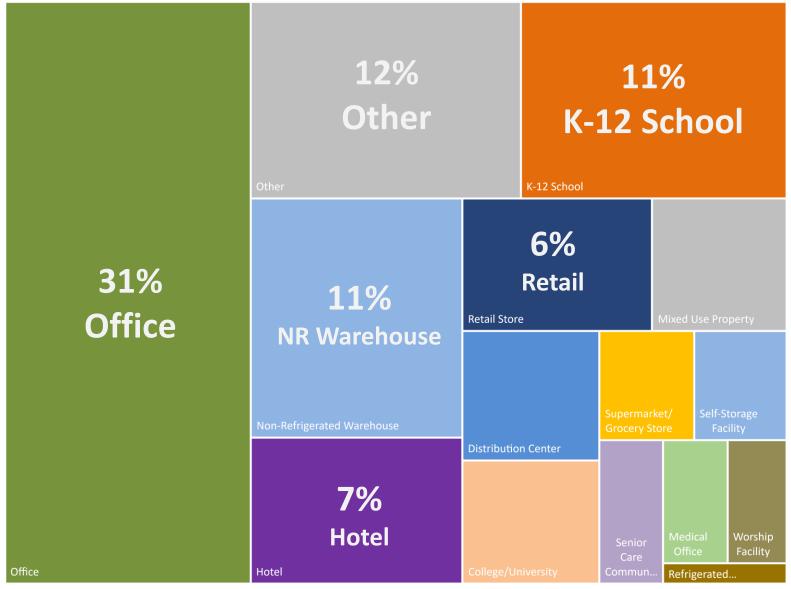


Seattle Market Overview

SMALL TO MEDIUM BUILDINGS			ALTERNATIVE COMPLIANCE PATH POTENTIAL		
Square Footage	Tune-Up Compliance	Est. Number of Buildings	ENERGY STAR >=85	"Certified" >=85	EUI <=20
70k-99,999	2020	160	45	4	14
50k-69,999	2021	230	31	4	26
20k-49,999	Optional	820	146	4	119
		1,210			

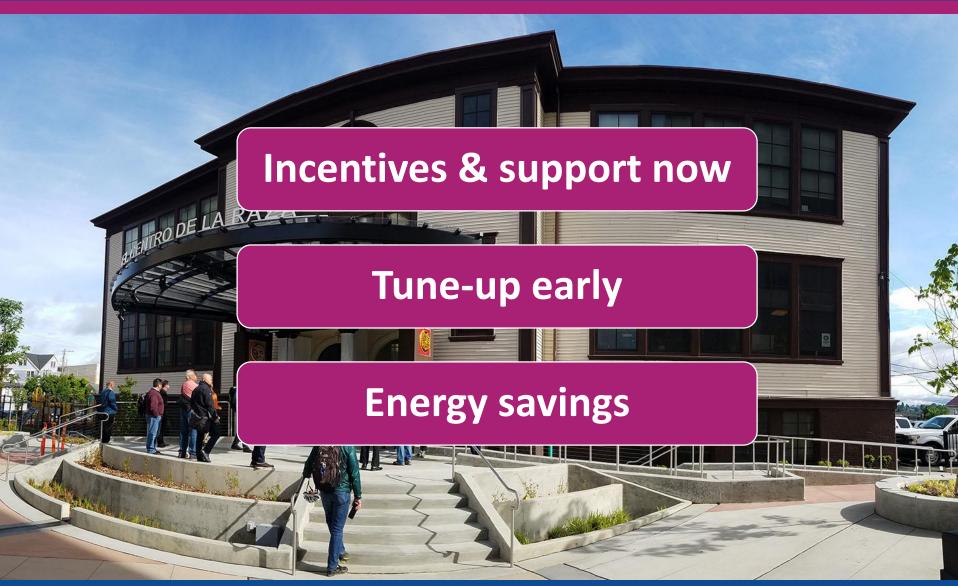
Source: 2015 Seattle Energy Benchmarking Data

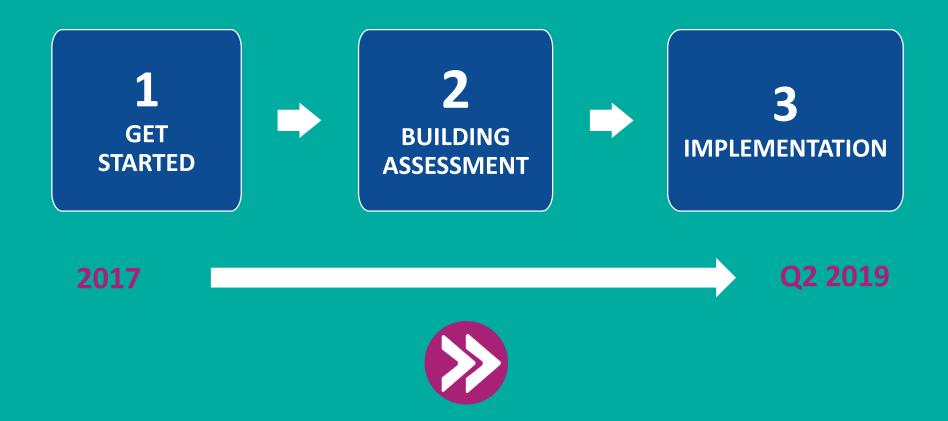
Primary Use Type – Percent of Total SF, 50-100K SF (excl. parking)



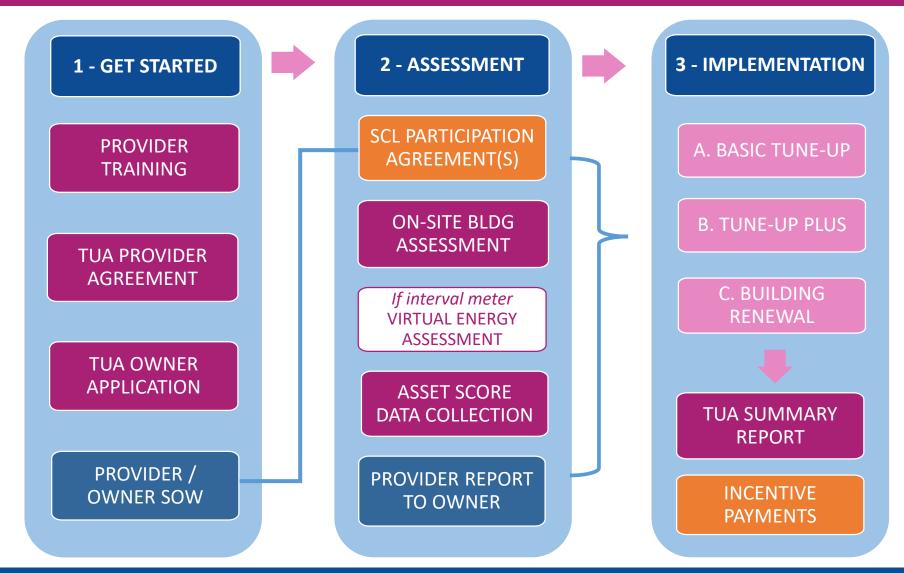
Source: 2015 Seattle Energy Benchmarking Data

What's in it for Owners?





Accelerator Overview – 3 Phases



GET STARTED: Training & Agreement

 Providers not already having signed a participating service provider agreement will need to complete ASAP with OSE



TUA PROVIDER AGREEMENT

PROVIDER TRAININGS

GET STARTED: Develop Your Scope w/ Owner

- Your own contract with owner.
- SCL will also need for the incentive Participation Agreement.
- TUA will create a high level "market report" to provide after program completion.

PROVIDER / OWNER SOW SCL PARTICIPATION AGREEMENT

GET STARTED: Explore Implementation Options

As part of SOW, consider options:

- Client/owner just wants a tune-up that meets Seattle BTU?
 - Basic Tune-Up
 SCL Incentives for Assessment & Corrective Actions
- Considering other ECMs or RCx?
 - Tune-Up Plus
 SCL or PSE Incentives, PSE CBTU Program
- Needing comprehensive work or energy modeling support?
 - Building Renewal Options
 SPARK analysis, energy modeling

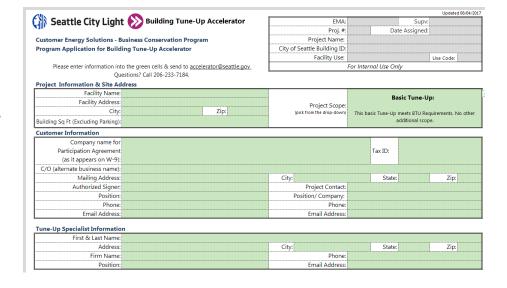
GET STARTED: Working with an Owner?

- Let us know!
- Must use current TUA
 Summary Report Form (online)
- We can provide some Portfolio Manager information as needed.



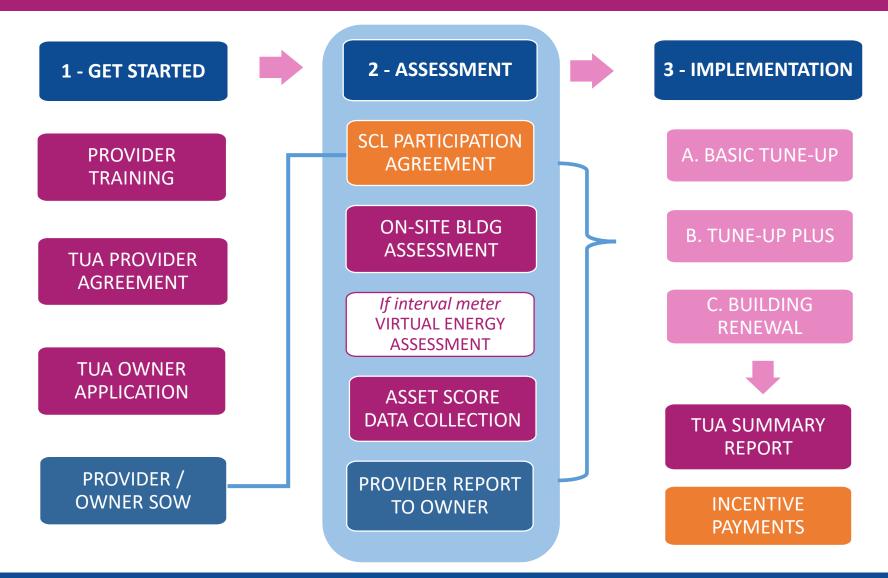
GET STARTED: Deliverables

- ✓ Tune-Up Accelerator
 Provider Agreement ASAP
- ✓ Tune-Up Accelerator Owner Application ASAP
- ✓ Service Provider SOW with Owner ASAP
- ✓ Start work on utility incentive agreements ASAP



Application and Provider List Available at: www.seattle.gov/buildingtuneups click on Accelerator "How to Enroll in the Accelerator"

Accelerator Overview – Assessment Phase



ASSESSMENT: On-Site Building Assessment

- SCL Participation Agreement in place?
- "Walkthrough" / BAS trending and billing analysis
- Borrow tools from SBC Tool Lending Library
- Assess Seattle Building Tune-Ups elements (at minimum) & Benchmarking Verification
- Collect Asset Score required fields.



SCL PARTICIPATION AGREEMENT

ON-SITE BLDG ASSESSMENT

ASSET SCORE
DATA
COLLECTION

ASSESSMENT: Got City Light Interval Data?

- About 50 downtown buildings in the 50K-100K range have 15-minute electric interval data
- Pilot test of Virtual Energy
 Assessment (VEA) for these buildings to use with your Assessment.
- We will let owners know if VEA is an option.

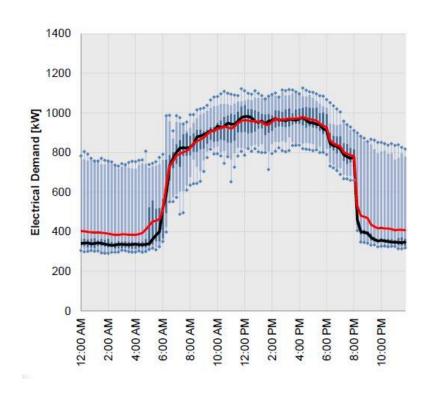


Image source: SBW

ASSESSMENT: Asset Score Data Collection

- Free web-based tool developed by that generates a "score" and suggest potential improvements.
- Accelerator Program is using to collect more building asset details to inform retrofit opportunities.
- Program wants to determine if this information helps motivate owners to take action beyond what is required by the tune-up.

https://buildingenergyscore.energy.gov







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ASSESSMENT: Asset Score Incentive Options

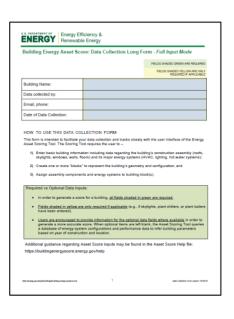
A – \$600 Incentive to Provider

- Return completed PDF form to OSE no later than 15 days after Assessment
- Provider sends invoice to OSE
- Asset Score Report provided to you and Owner.

B – \$1,000 Incentive to Provider

- Enter data into online tool, run report & provide to Owner
- Share online report with Accelerator (see handout)
- Provider sends invoice to OSE

https://buildingenergyscore.energy.gov



ASSESSMENT: Your Provider Report to Owner

- After Assessment is complete, your report to Owner
 - Identifies "Corrective Actions" to meet BTU requirements
 - Recommendations additional opportunities (Capital ECMs, other O&M, Renewal, etc.)
 - Your firm, owner staff or other vendor might implement
- Report needed for SCL Basic Tune-Up incentive

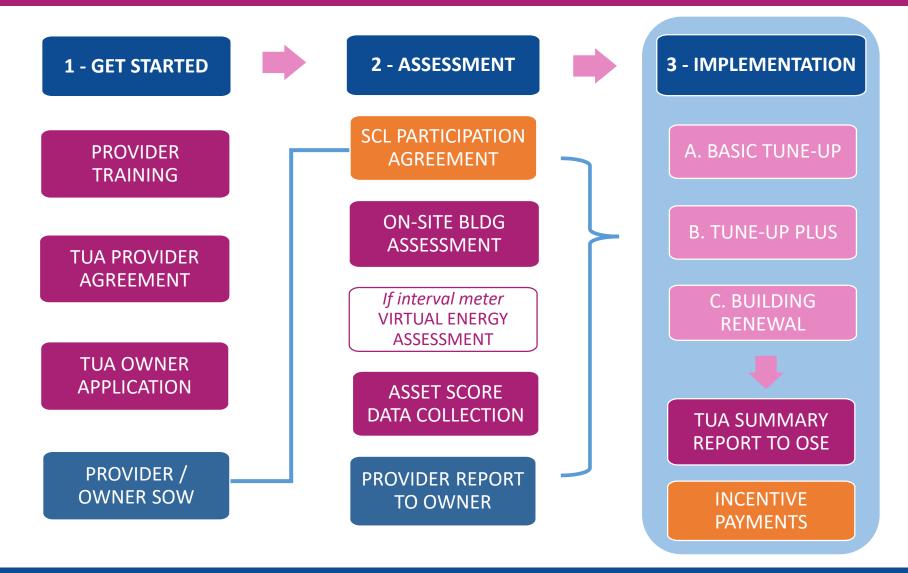
PROVIDER REPORT TO OWNER

ASSESSMENT: Accelerator Deliverables

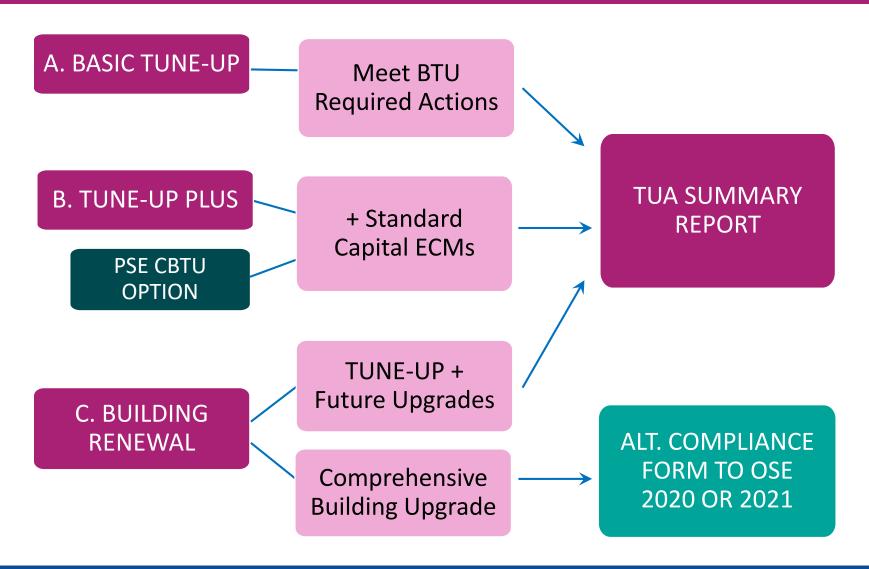
- ✓ Building Assessment by 8/30/2018
- ✓ Complete Asset Score data collection (15 days after assessment)
- ✓ Building Assessment incentive issued to Building Owner



Accelerator Overview - Implementation Phase



IMPLEMENTATION: Options



A. BASIC TUNE-UP INCENTIVE

Incentives per SF

A. BASIC TUNE-UP



- ☐ Up to **\$0.12*** per SF
 - \$.03 per SF City Light incentive for on-site Building Assessment
 - \$.09 per SF City Light incentive for Required Actions
- ☐ Complete all required corrective actions for Seattle Building Tune-Ups & submit Summary Report
- ☐ Pilot test of Virtual Energy Assessments
 - Available for ~60 buildings w/ interval meters

EXAMPLE:

75,000 SF Building

- Up to \$9,000 Total
- \$2,250 after assessment
- Up to \$6,750 at completion

*Incentive capped at 70% of tune-up costs

B. TUNE-UP PLUS INCENTIVE

Incentives per SF

B. TUNE-UP PLUS

- ☐ Basic Tune-Up (up to \$0.12 per SF)
- □ PLUS Capital ECMs (SCL or PSE) with incentives based on standard programs
 - Lighting, HVAC, etc.
 - Advanced Rooftop Controller Rebate
 - PSE incentives as applicable



EXAMPLE:

75,000 SF Building

- Up to \$9,000 Total
- \$2,250 after assessment
- Up to \$6,750 at completion*

+ ECM Example

 Standard SCL lighting retrofit covers 40-70% of project cost

*Incentives capped at 70% of tune-up costs

B. TUNE-UP PLUS — CBTU OPTION

Building has significant heating and/or cooling natural gas use?



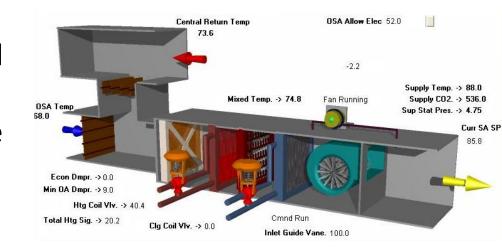
- Does owner wish to pursue a more comprehensive commissioning approach?
- Pre-approval by PSE & use of PSE approved provider required.
- Discuss first with PSE to see if gas use and potential savings qualifies – then work with City Light.

PSE CBTU ASSESSMENT AGREEMENT

C. BUILDING RENEWAL – DEEPER SAVINGS

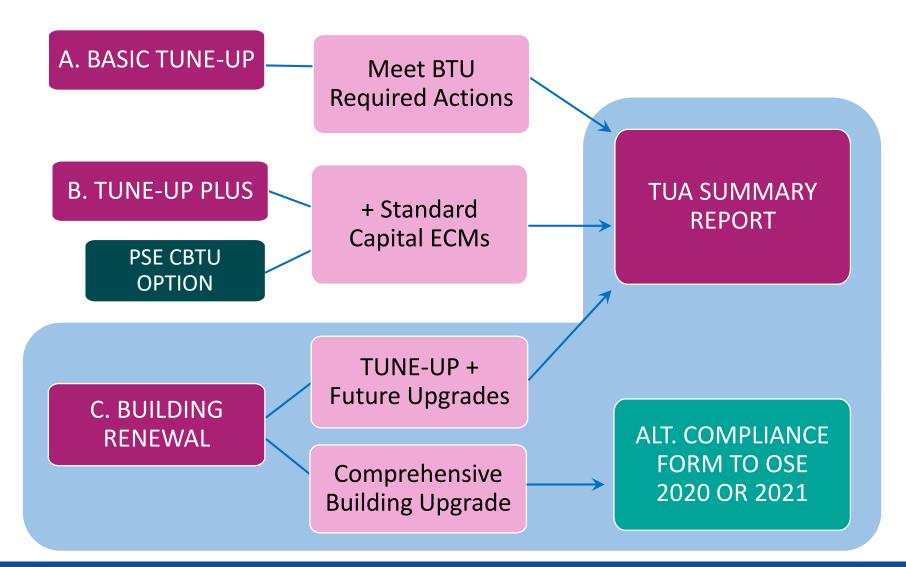
Resources for up to **25 participant buildings** pursuing deeper energy savings through building renewal at **three levels of project engagement**.

- SPARK Analysis
- Technical Assistance for Goal Setting/Lighting/Controls Retrofit Evaluation/Envelope upgrades
- Engineering Analyses
- SCL and PSE standard incentives could apply for deep retrofits





IMPLEMENTATION: Options



IMPLEMENTATION: Accelerator Deliverables

- ✓ Send complete **TUA Summary Report** to OSE by June 30, 2019 or sooner
- ✓ Complete all utility deliverables needed for incentive payments to building owner
- √ Final Tune-Up incentive \$ issued to Building Owner
- ✓ Additional incentive \$ if enrolled in Tune-Up Plus or Building Renewal



Accelerator M & V of Buildings

- About 10% of buildings will be asked to participate in Measurement and Verification (M & V)
- Goal is to look at projected vs. measured savings.
- May require one or more site visits to set up & retrieve data loggers.
- Results will not impact utility incentives or compliance.



Accelerator – Evaluation & Refinement

Program Final Report to DOE

- Energy and GHG savings analysis for program impact
- Pre and post tune-up energy use by fuel source (as available)
- Effectiveness of Asset Score as an analytic tool
- High level review of tune-up measures implemented
- Qualitative assessment of what motivated owners tools, support, data, incentives.
- Case Studies

Program Refinement and Scalability

- Recommendation for establishing long-term owner assistance and engagement
- Recommendation to OSE for Building Tune-Ups Rule updates

Data Privacy

- All building data in public reports will be anonymized or in aggregate groupings.
- Building owner, service provider names and identifying project details will only be used with permission.
- Personal information is subject to Washington Public Records Act, and may be subject to disclosure to a third-party requestor.



Helpdesk Support from SBC

Help Desk Hotline 206-800-7211

Help Desk Email accelerator@seattle.gov



Next Steps

- Financing options under consideration
- Service Provider agreement ASAP (if needed)



TUNE-UP ACCELERATOR SUMMARY REPORT DEMO



QUESTIONS?





15 Minute Break

DOE Building Energy Asset Score

PRESENTED BY:

Richard Fowler, PNNL Energy Asset Score Technical Support asset.score@pnnl.gov buildingsenergyscore.energy.gov





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Learning Objectives and Course Outline

Learning Objectives

- Awareness of the Asset Score tool
- Understand basics of data collection, tool navigation, data entry, and score reports
- Insight into tool best practices
- Know where to go for help and additional resources

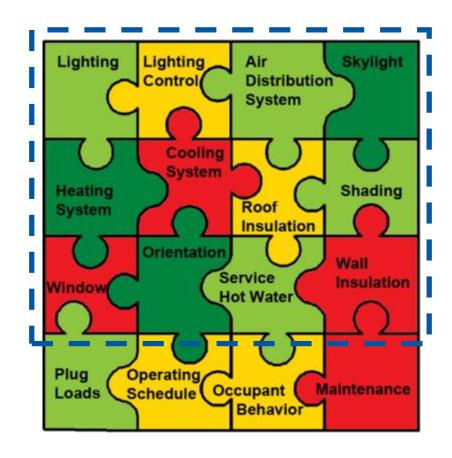
Course Outline

- I. Introduction to Asset Score
- II. Data Collection
- III. Using Asset Score: Entering Data and Generating Score Reports



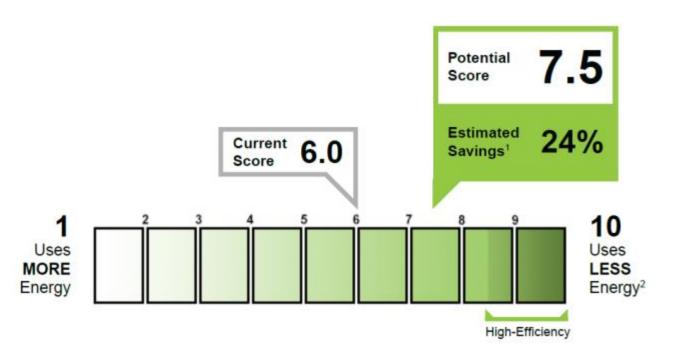
What is Building Energy Asset Score?

- Free web-based tool for assessing the physical and structural energy efficiency of commercial and multifamily residential buildings
- Evaluates building energy "assets": envelope and major energy-related systems and equipment
- Identifies opportunities for improvement



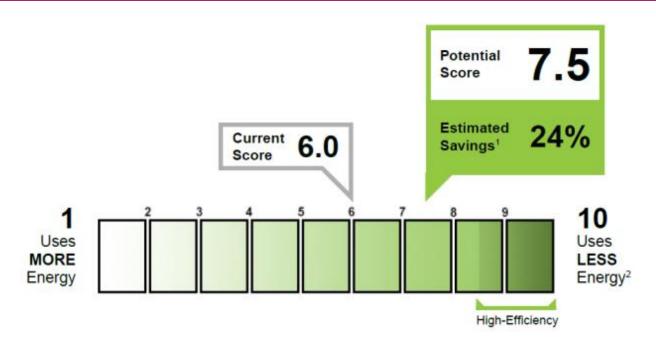
What Does the Asset Score Tool Do?

 Generates an energy asset score and produces an asset score report





Asset Score Scale



Key components:

- Shaded 10-point gradient represents a building's efficiency
- Current Score
- Potential Score
- Estimated savings



Why was the Asset Score Tool Developed?

- Expand nationwide awareness of opportunities to invest in building energy upgrades.
- Quick, easy to use tool to help guide energy improvement decisions and investments.
- Not intended as a replacement for building energy usage benchmarking or building energy audits, but a complimentary tool
- Help make your job easier and faster
- Thousands in savings identified to date by users such as NOAA,
 Murphy & Miller, Inc., Missouri Department of Economic Development









BUILDING ENERGY

ASSET SCORE

Asset Score and the Tune-Up Accelerator Program

 Why is Asset Score a part of the Tune-Up Accelerator Program?

What will DOE/OSE do with the collected data?





How Do I Score a Building?

Three Steps:

- 1. Collect Building Data During "Assessment" Phase
- Enter Data into the Asset Score Tool
- 3. Generate an Asset Score Report





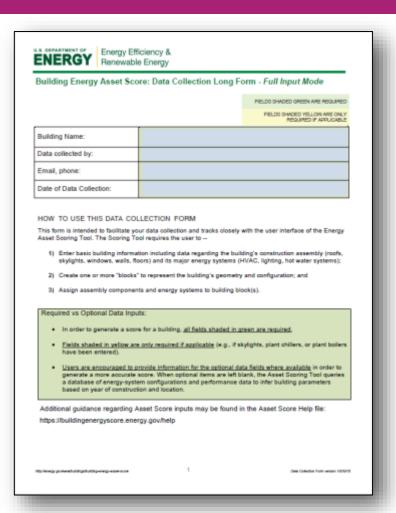


Data Collection Method and Forms

- Perform a building walkthrough
- Record data
- Asset Score Data Collection Form:

Short form: minimum required data fields necessary to generate an Asset Score; simple building and limited knowledge of asset details

Long form: all building shapes, mixed use types, complex HVAC systems, all tool input fields

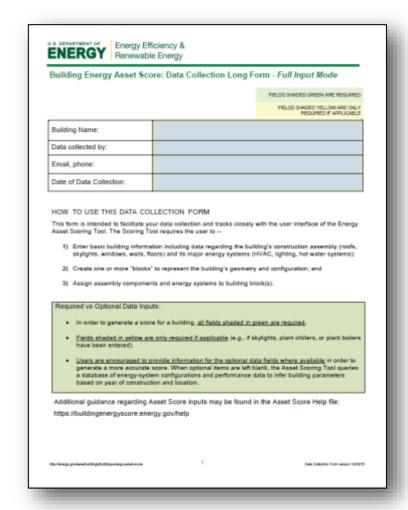


https://buildingenergyscore.energy.gov/resources



Data Collection Long Form

- Complete electronically or print out and complete manually
- Organized to match the data entry steps in the tool user interface
- All fields shaded in green are required
- Fields shaded in yellow are only required if applicable





Data Collection Form - Required Fields

Required input fields for the following sections of the Data Collection Form and the Asset Score Tool include:

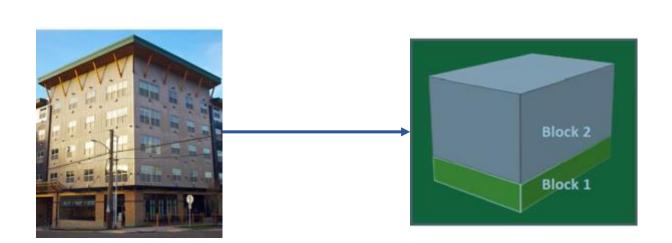
- General Building Information: Year of completion; gross floor area; location; building use type
- Construction Properties (Envelope components): Roof, exterior wall, and floor types; fenestration types and window to wall ratio
- **Lighting:** Fixture and mounting types, lamp wattage and lamps per fixture (to calculate lighting power density)
- Heating and Cooling: Heating and cooling source, distribution equipment type
- **Geometry:** Building ("block") footprint shape and dimensions, number of floors, floor-to-floor/ceiling height, orientation



Building Blocks

Graphical representations of your building's footprint

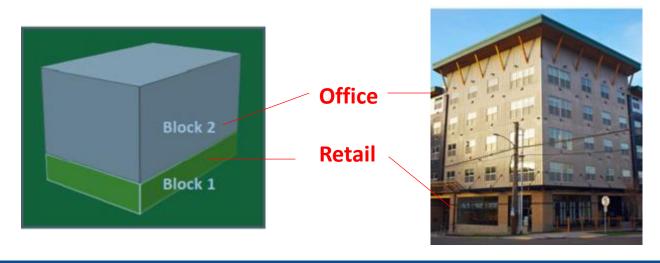
and shape





General Building Information

- Accounts for the age of the building, its size, location, and use
- Building use type
 - Select from the 19 available use types
 - Make note of the square feet for each use type
 - For mixed-use buildings, choose up to 5 use types. Each use type must be >2500 sq ft and >5% of the total building GFA
 - See Use Type handout to compare to Tune-Up selections

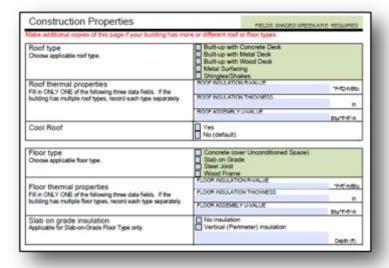


BUILDING ENERGY

ASSET SCORE

Construction Properties

- Physical characteristics of the building envelope: roofs, floors, walls, fenestration types
- Thermal properties
- Surface entries for walls and windows
- Window to Wall Ratio: calculate manually (continuous), or have the tool calculate (discrete); may use estimates





ASSET SCORE

Lighting

- Asset Scoring Tool needs a lighting power density (watts per square foot) value for each block
- Lighting fixture types and numbers, lamps and wattage
- Total # of fixtures vs. % area served: percent served is simpler and quicker in most situations

Fixture	Lighting type	Total Number of Fixtures	% Area Served	Occupancy Controls (yes/no)
a.	Compact fluorescent			
b.	Fluorescent T5			
C.	Fluorescent T5 - High Output			
d.	Fluorescent T8			
е.	Fluorescent T8 - High Efficiency			
f.	Fluorescent T12			
g.	High-pressure sodium			
h.	Incandescent/Halogen			
i.	LED			
j.	Mercury vapor			
k.	Metal halide			



BUILDING ENERGY

ASSET SCORE

HVAC Systems

- HVAC System Types: helpful for data entry and/or if additional details are unknown
- Heating and Cooling Sources: Complete plant loop pages as necessary
- Equipment Details: Additional settings and options may be configured for quantity, capacity, efficiency
- Distribution Equipment (AHU vs. Zone Equipment): Additional settings and options may be configured for fan motors, controls, etc.
- Enter closest match if equipment or system is not listed, or see Users Guide or contact Help Desk for advice

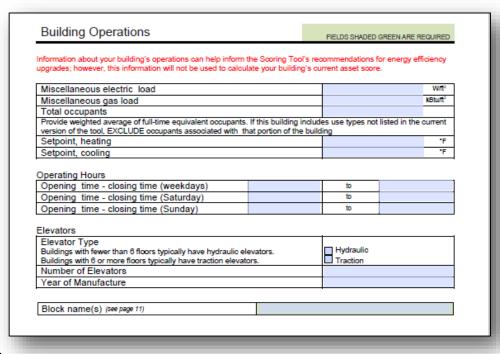




https://help.buildingenergyscore.com

Building Operations

- Optional: Inputs are not used to calculate the building's Asset Score
- Used to identify upgrade opportunities, which are considered in generating the potential score
- Operational and Equipment Sizing Assumptions:



https://buildingenergyscore.energy.gov/assets/energy_asset_score_assumptions.pdf

How Do I Score a Building?

Three Steps:

- 1. Collect Building Data During "Assessment" Phase
- 2. Enter Data into the Asset Score Tool
- 3. Generate an Asset Score Report





Asset Score Tool

Create an account, register, log in:

https://buildingenergyscore.energy.gov

ENERGY Energy Efficiency & Renewable Energy					
,	Asset Sco	ore			
	Building Energy Asset S	score » Asset Score Home			
	Log In		•		
D ₀	Email	Email address			
	Password	Password			
		◆ Log In			
	Forgot your passw	ord? Register			

BUILDING ENERGY

ASSET SCORE

Create a Building

Quick Start Guide -- 6-Step Process

https://buildingenergyscore.energy.gov/assets/asset_score_quick_start_guide.pdf

Step 1: Input Basic Building Information

Step 2: Identify Building Use Types

Step 3: Create Inventory of Building Features

Step 4: Create a 3-D Image of the Building

Step 5: Assign Use Types and Components

Step 6: Score your Building and Review Asset Score Report



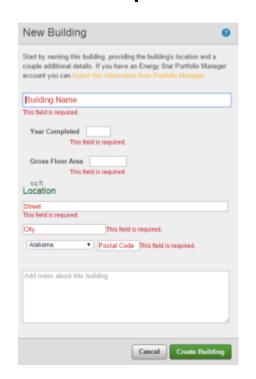


Steps 1-3: Input Data

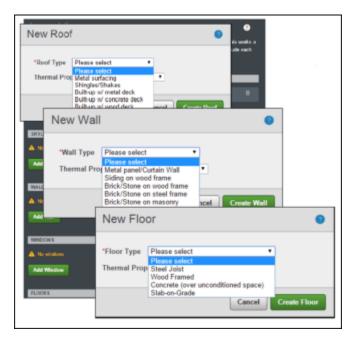
Step 1: Input Basic Building Information (Optional: may import from ESPM)

Step 2: Identify Building Use Types

Step 3: Create Inventory of Building Features

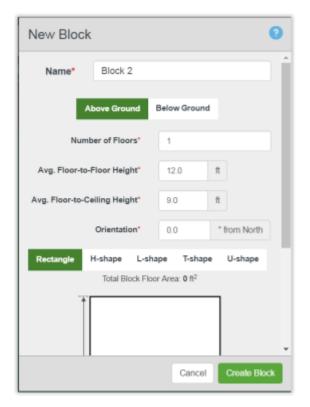


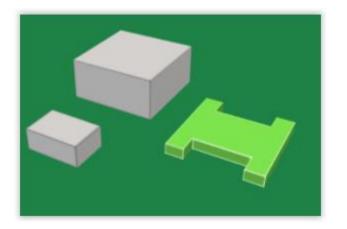


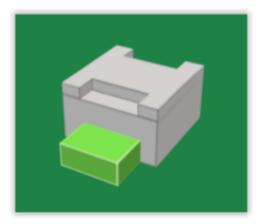


Step 4: Create a 3-D Image of the Building







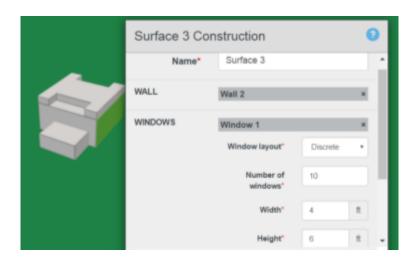


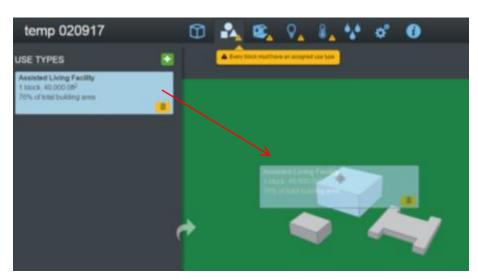


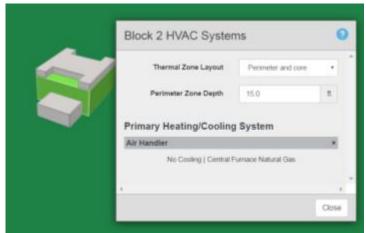
ASSET SCORE

Step 5: Assign Use Types and Components

- Drag and drop assets onto blocks
- Click blocks to add details for surfaces, lighting, HVAC, water heaters







ASSET SCORE

Step 6: Score Building and Review Score Report



- Review inputs
- Select Score button
- Wait for Email notification
- My Buildings page status icons
- Download report
- Return to edit mode
- Duplicate buildings

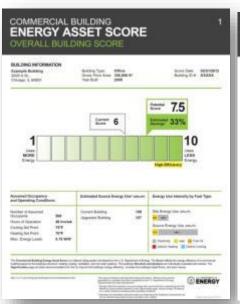




Asset Score Report

- Review score results and report sections
- See score report and building upgrade guides for details – available from the Resources page

Overall Building Score



Upgrade Opportunities



Structure and Systems



Building Assets

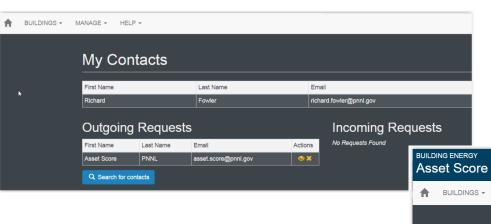
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BUILDING SYSTI	EM CHARACTERISTICS SUMMARY		
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	Server.	Skytlytv	
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Mindre to Park Today	DA DOMESTIQUESTY		
Window SHEET	Different"		

ASSET SCORE

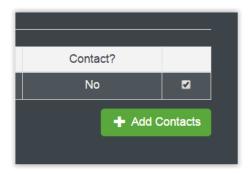
Creating Contacts and Sharing Buildings

Share buildings with contacts:

- Add Contacts
- Share Buildings







Building(s) were successfully shared.



BUILDING ENERGY

ASSET SCORE

Using Asset Score with the Accelerator Program

- Share building entries with the Tune-Up Accelerator Program: see handout for instructions
- Options for help with entering data: contact Nicole Ballinger, Building Tune-Up Accelerator Program Manager
- Where to go from here?
 - Take action on recommended upgrades
 - Identify opportunities for deeper energy savings analysis and goal setting
 - Building Renewal University of Washington Integrated Design Lab





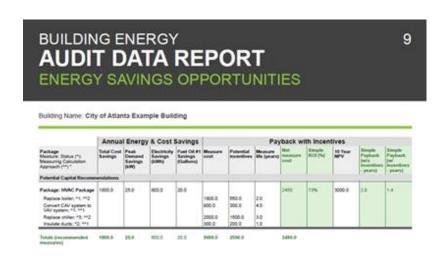


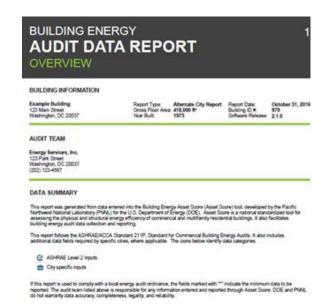


New Asset Score tool feature: Audit Template

- Collect, store and report building energy audit data
- Includes fields present in an ASHRAE Level 2 audit
- Audit data report may be submitted to cities to demonstrate audit completion (e.g. NYC and SF)
- Report includes calculated tables and charts outlining building energy use
- Currently available by selecting







ASSET SCORE

Additional Resources

Resources page

https://buildingenergyscore.energy.gov/resources

Asset Score Help Desk

https://help.buildingenergyscore.com/

DOE FAQ page

https://energy.gov/eere/buildings/building-energy-asset-score-frequently-asked-questions

- Handouts
- PNNL and OSE staff



Conclusion

- Review objectives
- Thank you!
- Questions?



ASSESSMENT: Asset Score Incentive Options

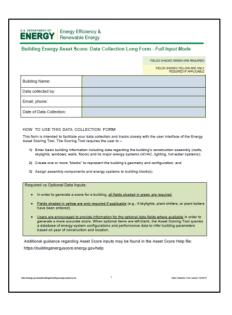
A – \$600 Incentive to Provider

- Return completed PDF form to OSE no later than 15 days after Assessment
- Provider sends invoice to OSE
- Asset Score Report provided to you and Owner.

B – \$1,000 Incentive to Provider

- Enter data into online tool, run report & provide to Owner
- Share online report with Accelerator (see handout)
- Provider sends invoice to OSE

https://buildingenergyscore.energy.gov



QUESTIONS?





LUNCH BREAK

Diagnostic Tool Lending Library

Duane Lewellen

Tool Lending Library Director Smart Buildings Center

















Tool Lending Library at the SBC

- 85 types of diagnostic tools
- Online reservation system
- Loan period up to 4 weeks
- Local pickup or shipping
- Open 9am to 4pm
 Tue., Wed., Thur.



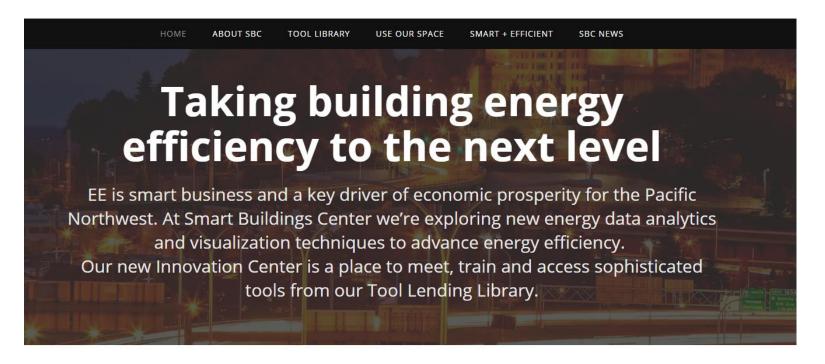
FREE !!!

Online Tool Reservation System

SMART
BUILDINGS
CENTER A project of NEEC

Introducing SBC-EP: Smart Buildings Center Education Program Launch

Search this website



INNOVATION CENTER

TOOL LIBRARY

SMART + EFFICIENT

EE BENEFITS









Tool Delivery & Return





Pick up and return to the Smart Buildings Center Tuesday thru Thursday 9am-4pm

Delivery and return via shipping

Tool Lending Policies

CUSTOMER AGREEMENT

- ➤ NEEC is not liable for any damages arising out of use of the tools
- Agree to return tools in good working order and on time
- Agree to replace tool(s) if they are damaged or lost
- Power and flowmeters are not revenue grade and should not be used for utility billing

TOOL LENDING POLICY

- > Tool availability on a first come, first served basis
- > Tools can be reserved for future use
- Electric power meters must be installed by licensed, qualified electrician
- Infrared cameras and ultrasonic flow meters require certificate of insurance prior to loan

Diagnostic Tool Packages

Seattle Tune Up Accelerator Diagnostic Tool Packages

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Tune Up Assessment Elements	Diagnostic Approach	Diagnostic Tool Application(s)
Heating Ventilation, and Air Condition		
Review HVAC equipment schedules (Including daily weekly, seasonal, day/night, occupied/unoccupied hours).	Record start/stop operation of supply fans, return fans, exhaust fans pumps, chillers, and boilers associated with HVAC equipment and compare to occupancy schedule(s)	Electric motor logger Electric contact logger Energy/Power logger
Review HVAC set points (including space temperatures, supply air temperatures, CO2, boiler temperatures, chilled water temperatures, economizer changeover temperatures, and building pressure).	Measure operating condition(s) and compare to setpoint:	Static Measurements: Vane Anemometer Thermal Anemometer Hand-held Infrared Thermometer Digital Psychrometer Digital Manometer Logging: Temp/Humidity/Light Logger 4-Channel Logger With Remote Sensors WIFI Temp/Humidity logger Carbon Dioxide meter with data logger Desktop IAQ logger Carbon Monoxide logger Differential pressure transmitter with data logger
	Review HVAC set points (including space temperatures, supply air temperatures, cooling temperatures, economizer changeover temperatures, and	Review HVAC equipment schedules (Including daily weekly, seasonal, day/night, occupied/unoccupied hours). Review HVAC set points (including space temperatures, supply air temperatures, economizer changeover temperatures, and schedules) Review HVAC set points (including space temperatures, collection of supply fans, return fans, exhaust fans pumps, chillers, and boilers associated with HVAC equipment and compare to occupancy schedule(s) Measure operating condition(s) and compare to setpoint:

Diagnostic Tool Applications

- HVAC
- Lighting
- Domestic Hot Water
- Water Use











Equipment Start/Stop Schedules

<u>Application:</u> Supply fans, return fans, exhaust fans, terminal unit fans, boilers, chillers, circulation pumps

<u>Diagnostic Approach:</u> Log equipment operating schedule and compare to building occupancy



Onset Hobo Motor Logger



Dent Elitepro XC Energy logger



Fluke 1730 Energy Logger



Dent Motor Maglogger

Verify Set Points & Sequence of Operation

<u>Application:</u> Zone temperature, supply air temperature, boiler supply water reset, chilled water reset, outside air temperature, mixed air temperature, economizer high limit

<u>Diagnostic Approach:</u> Measure or log temperature conditions and compare to set point



Sensor Calibration

<u>Application:</u> Temperature sensors, humidity sensors, air/water flow sensors, CO2 sensors, CO sensors

<u>Diagnostic Approach:</u> Measure condition and compare to sensor

output



GE Ultrasonic Flow Meter

Fluke 975 Thermal Anenometer



Vaisala MI70 Temp/Humidity/CO2 meter





Airflow & Ventilation Measurements

<u>Application:</u> Supply/exhaust/return air cfm, outside air cfm, CO2 levels, building pressure, duct pressure

<u>Diagnostic Approach:</u> Measure airflow or pressurization and

compare to desired condition



Dwyer Digital Manometer



TSI Vane
Anenometer



Differential Pressure Logging

Thermal

Anenometer



CO2 Measurement & Logging

Flow Hood

Lighting Levels & Controls

Application: Evaluate light levels and automatic control systems

<u>Diagnostic Approach:</u> Measure light levels and compare to standards, verify correct operation of occupancy and daylighting sensors





Light Meter - Fluorescent



Light Meter - LED



Light Level Logger



Light & Occupancy Logger

Domestic Hot Water Applications

<u>Application:</u> Verify hot water temperature and proper operation of recirculation system controls

<u>Diagnostic Approach:</u> Measure hot water temperature. Verify schedules for recirculating systems



Laser Thermometer



4-channel logger with external sensors



Motor logger

Water Usage Applications

<u>Application:</u> Verify irrigation sensors are calibrated, calibrate conductivity controller sensors, verify water feature schedules

<u>Diagnostic Approach:</u> Measure and calibrate sensors, log water feature pump operation









Motor logger

QUESTIONS?



Observation & Data-Driven Building Re-Tuning Training for Seattle Buildings

PRESENTED BY:
Duane Lewellen
Smart Buildings Center

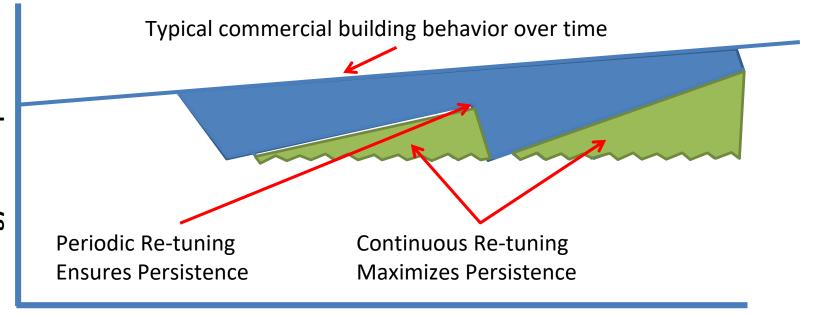


Proudly Operated by Battelle Since 1965

Goals for this portion of training

- Review building Re-tuning best practices for non-BAS and BAS applications
- Discuss applicability to buildings in the City of Seattle
 - as requirement for buildings >50K SF
 - encouraging re-tuning as a best practice in buildings <50K SF
- Provide opportunities for attendees to ask questions and get clarification on the re-tuning process and the SBTU requirement

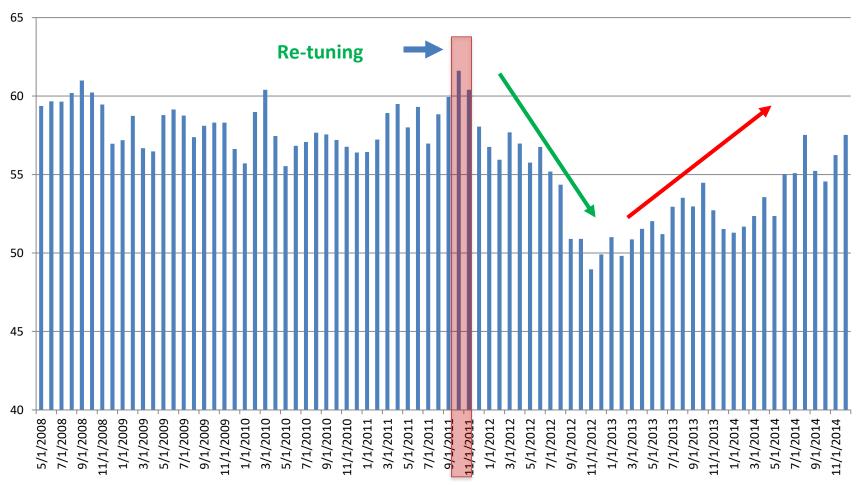




Time

Observation-Driven Building Re-tuning Training: Definition





Summary of Meta-Data Results Relevant to Small- and Medium-Size Buildings without Building Automation Systems

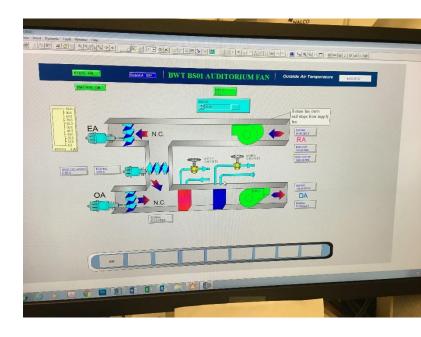
	Small Office	Medium Office	Strip Mall	StandAlone Retail	Primary School	Supermarket
EEM01: Re-calibrate Faulty Sensors	1%	0%	1%	1%	0%	0%
EEM04: Shorten HVAC Schedules	6%	12%	9%	12%	8%	10%
EEM05: Supply Air Temperature Reset		11%			4%	
EEM07: Exhaust Fan Control	3%	1%		2%	1%	
EEM08: Static Pressure Reset		4%			0%	
EEM14: Hot Water Temperature Reset					5%	
EEM15: Minimum VAV Terminal Box Damper						
Flow Reductions		19%			6%	
EEM16: Wider Deadbands and Night Setbacks	12%	10%	11%	13%	16%	12%
EEM27: Optimal Start	6%	8%	10%	12%	6%	
EEM28: Optimal Stop		0%	1%	2%	1%	

Summary of Meta-Data Results Relevant to Large Buildings with Building Automation System

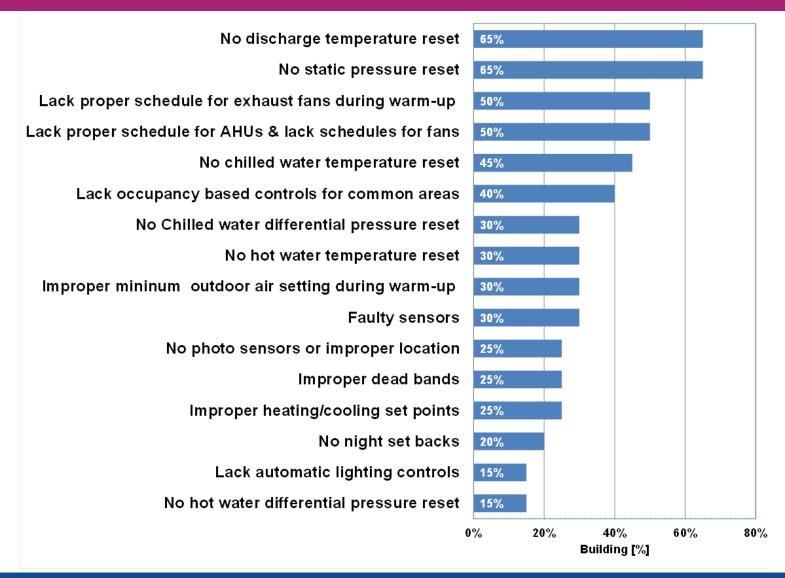
	Large Office	Large Hotel	Secondary
EEM01: Re-calibrate Faulty Sensors	1%	0%	0%
EEM04: Shorten HVAC Schedules	14%		16%
EEM05: Supply Air Temperature Reset	10%	11%	2%
EEM07: Exhaust Fan Control	1%		1%
EEM08: Static Pressure Reset	4%	2%	0%
EEM10: Chilled Water Differential Pressure Reset	0%	0%	0%
EEM11: Chilled Water Temperature Reset	1%	0%	0%
EEM13: Hot Water Differential Pressure Reset	0%	0%	0%
EEM14: Hot Water Temperature Reset	1%	0%	1%
EEM15: Minimum VAV Terminal Box Damper Flow			
Reductions	18%	0%	3%
EEM16: Wider Deadbands and Night Setbacks	10%	8%	12%
EEM27: Optimal Start	10%		14%
EEM28: Optimal Stop	3%		2%

Data-driven Re-tuning

- Approach: use the building's building automation system (BAS) to identify and correct building operational problems that lead to energy waste
- For buildings with BAS
 - Typically 50,000 square feet or more
 - Front-end data drives re-tuning process



Common Re-tuning Measures: PNNL Meta Analysis of 100 Buildings



Building Tune-Up Focus Areas With BAS

- Occupancy Scheduling
- AHU Discharge Air Temperature Control
- AHU Discharge Air Static Pressure Control
- AHU Heating and Cooling Control
- AHU Outdoor Air Operation
- AHU Economizer Operation
- Zone Conditioning
- Heating Plant
- Cooling Plant
- Meter Profiles

Observation-Driven Building Re-tuning Training: Definition

Building re-tuning is a systematic process to identify and correct no/low cost operational problems that lead to energy waste

 Many of the recommendations for efficiency improvements will be prescriptive



Observation-Driven Building Re-tuning Training: Approach

It will use a four step approach

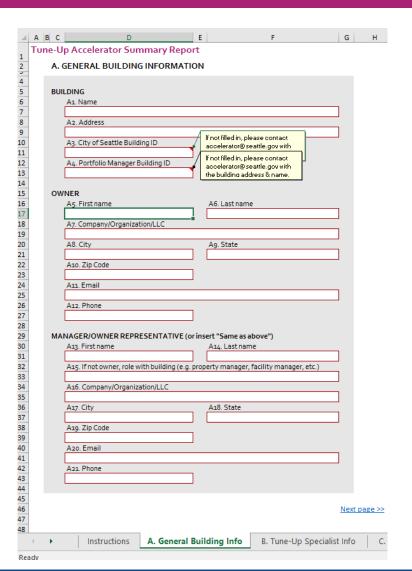
- Initial data collection phase: Collection of information about the building
- 2. Investigation phase: Building walk down to identify and characterize the building operations
- **3. Implementation phase:** Application of prescriptive re-tuning measures
- **4. Documentation phase:** Reporting of measures implemented and calculation of energy savings



Initial Building Data Collection

Tune Up Accelerator Summary Report

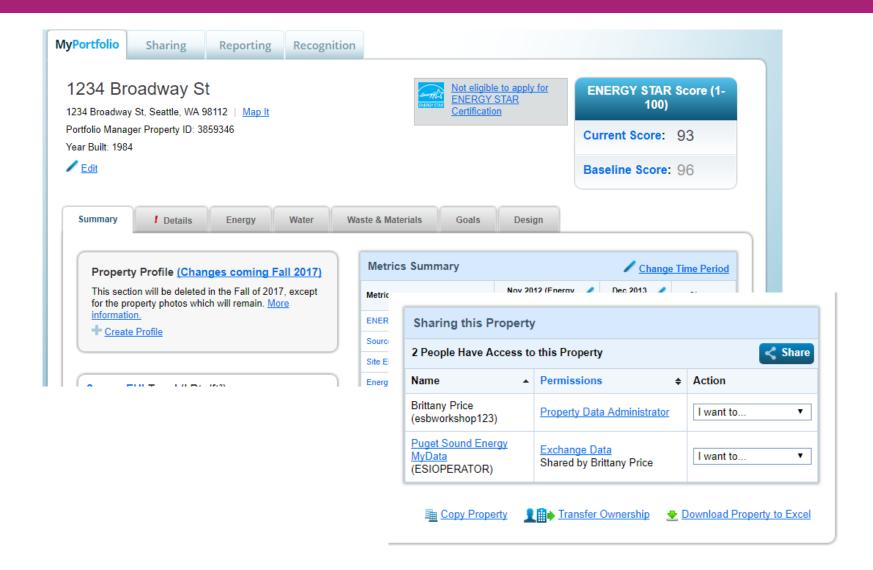
- A. General building information
- B. Tune up specialist credentials
- C. Building characteristics
- D. Benchmarking validation
- E. Utility billing analysis



Basic Building Information Resources...

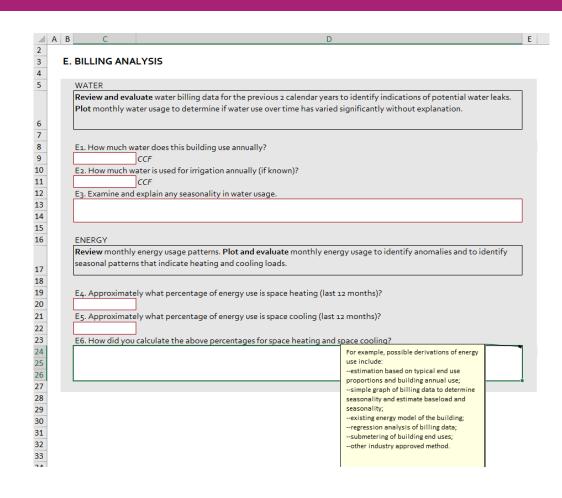
- Size, age and type of building
- As-built and construction documents
- O&M Manuals, Sequence of Operations (SOO)
- Types of equipment, recent repairs
- Equipment maintenance schedules
- Review logs (e.g. tenant complaints, etc.)
- Construction or changes to the building
- Building occupancy/equipment schedules
- Use/mission of the building
- Meter data (Utility for Electric, Gas, Oil, etc...)

Portfolio Manager Data Export



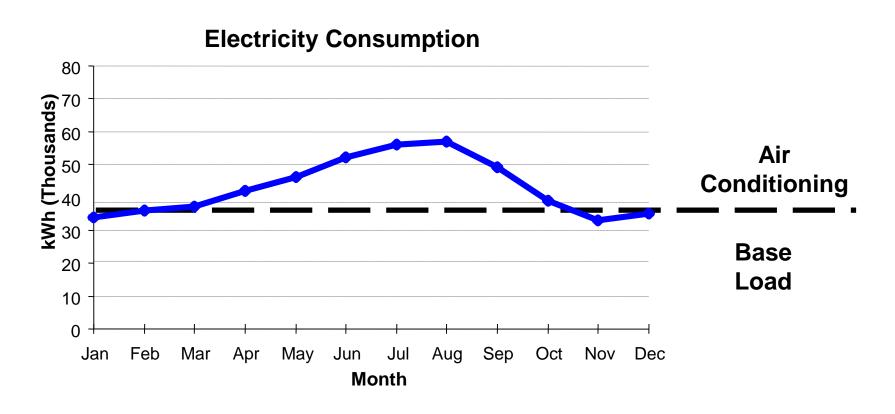
Utility Billing Analysis

- Annual water use
- 2. Irrigation water use
- 3. Seasonal water use variation
- 4. Monthly energy use patterns
- Annual heating & cooling energy use



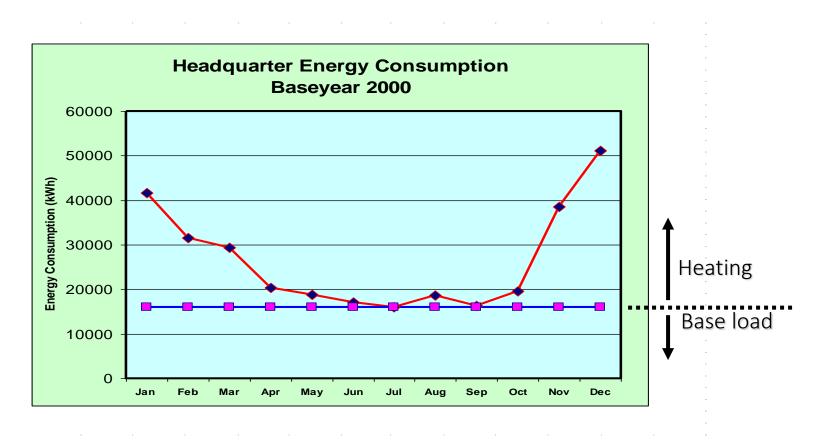
Utility Billing Analysis - Cooling

Base & Seasonal Loads - Cooling



Utility Billing Analysis - Heating

Base & Seasonal Loads - Heating



Small/Medium-Sized Building Re-tuning Training: Major Focus Areas

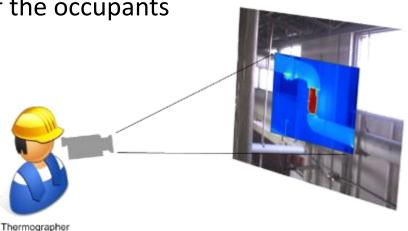
- Heating, Ventilation and Air-Conditioning Systems and Controls
- Lighting System and Controls
- 3. Domestic Hot Water
- 4. Water Use
- 5. Building Envelope





Observation-Driven Building Re-tuning Training: Basic Energy Management Principles

- If you don't need it, turn it off
- If you don't need it at full power, turn it down
- Make "smart" energy decisions when adjusting systems to the real building needs
- Save energy without negatively impacting the comfort of the occupants







Building Walk Down: Investigation Phase

- This is the second step in the building retuning process – the Investigation Phase
- Information collected in this step is used to identify the operational problems and energy saving opportunities that are fed into the plan for implementation of retuning measures

Reminder: Sample Size Tune-up Mandate

- In buildings where there are multiple pieces of similar equipment, the City's mandate requires:
 - Minimum sample size of at 12%
 - But no fewer than a sample size of 10 for buildings
 <100,000 sf and no fewer than 20 for buildings
 >=100,000 sf







VAV Terminal Units

Building Walk Down: Guidance

- While walking down to investigate the building's condition and operations, be vigilant, use your senses – look, listen, smell and touch (be careful!)
- If possible, perform the walk down during both occupied hours and unoccupied hours
- A lot of energy waste typically occurs during unoccupied periods and holidays
- Walk down at least once during the heating season and the cooling season
- Log all information on the log sheets this will help you calculate energy savings

"You can observe a lot by just watching."

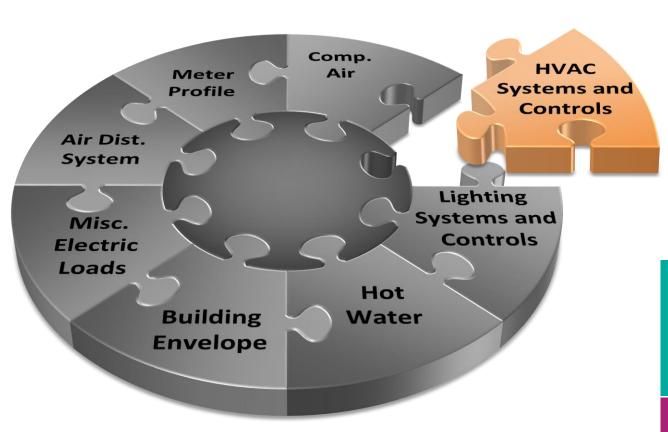
—Yogi Berra

Building Walk Down: Tools to Carry





Building Walk Down: HVAC Systems and Controls



HVAC

- HVAC Systems
- Economizers
- Distribution systems
- Pumps
- Thermostats

Seattle Building Tune-Ups Rule:

Table 1: 1.a-g & 1.j
Table 2: 1.a-c & 1.e

Tab G on Report

11 HVAC Assessment Elements –Directors Rule Table 1 (Tab G on Tune-Up Accelerator Summary Form)

- Equipment scheduling
- 2. Review setpoints
- Review reset schedules and setpoints
- 4. Review optimum start/stop if applicable
- Sensor calibration (critical sensors)
- 6. Controls functional testing
- Simultaneous heating and cooling
- Air balance issues
- 9. Ventilation
- 10. Identify any "rogue" temperature zones on multi-zone systems
- 11. Recommended maintenance, cleaning and repair



HVAC Equipment Scheduling

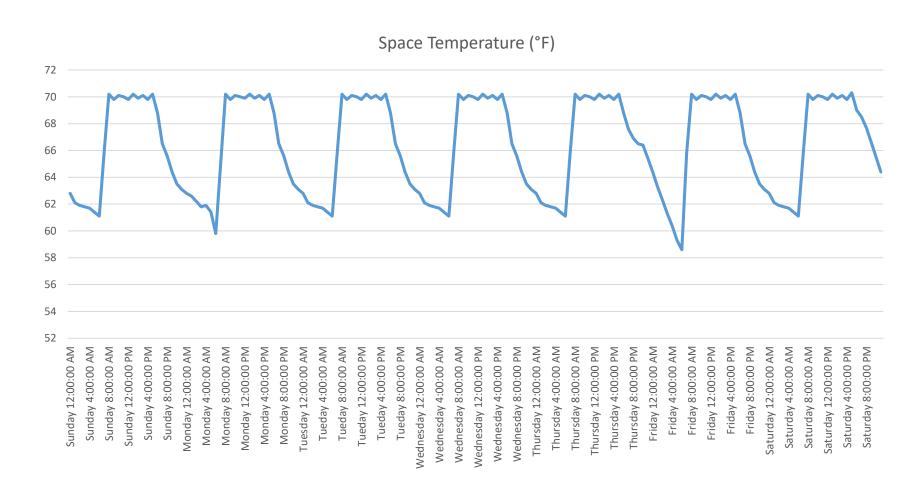
- Small/medium-sized commercial buildings typically lack central controls
- Typically have wall mounted thermostats to control both heating and cooling systems
- While surveying the thermostats and their capabilities, check:
 - Type of thermostat?
 - Mechanical or digital?
 - If digital, is it programmable?
 - If mechanical, replacing it with a programmable digital thermostat will save energy, if it is properly programmed



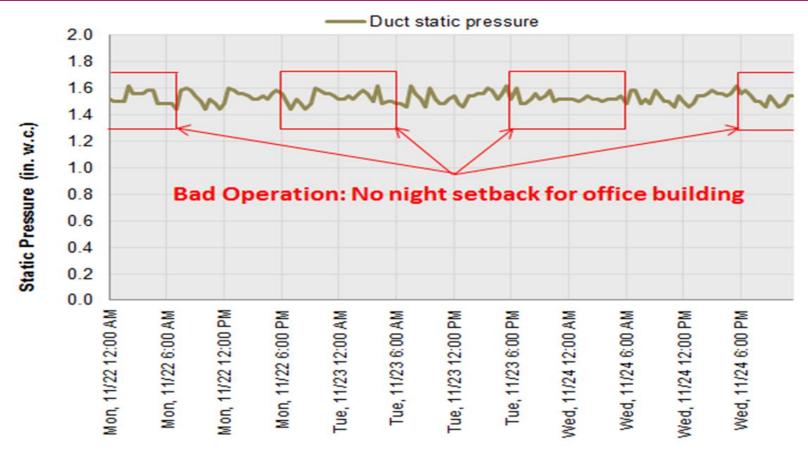




Equipment Scheduling – BAS Trend Data



Occupancy Scheduling: Set back for Unoccupied Hours?

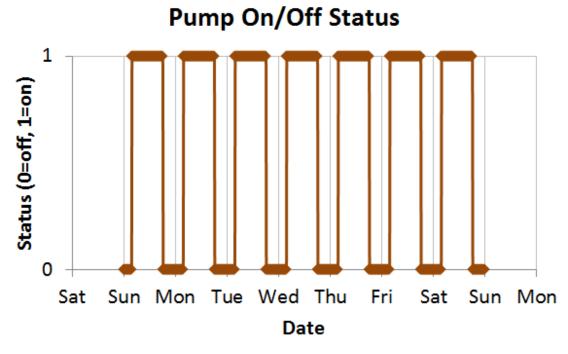


During unoccupied hours, the system should be set back so that the system does not continue to operate

Equipment Scheduling – BAS Trend Data

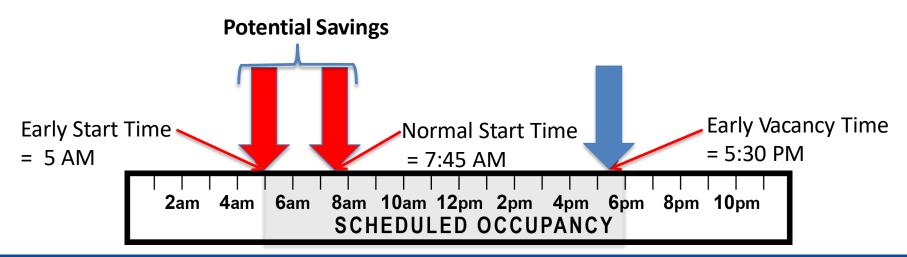
Use BAS trend data or data logger to verify start/stop scheduling of fans and pumps





Building Walk Down: HVAC System Controls – Thermostats Optimal Start

- Optimal Start (OS) is a feature that can save energy over traditional scheduling programs
- Most schedules are configured to start the HVAC system at the time it would take to heat or cool the space under worst case conditions
- OS will automatically "learn" over time, the optimum time to start the HVAC system to bring space temperatures within 1 to 2°F of occupied requirements at the start of the occupied time period



Review Setpoints

- 1. Zone temperatures
- 2. Discharge air temperature
- 3. Discharge air pressure
- 4. Minimum OA
- 5. HW & CHW supply
- 6. Condenser water supply
- 7. Differential pump pressure
- 8. Economizer changeover
- 9. OA lockouts
- 10. Miscellaneous equipment such as exhaust and process driven systems (elevator machine rooms, data rooms, garage exhaust, etc..)

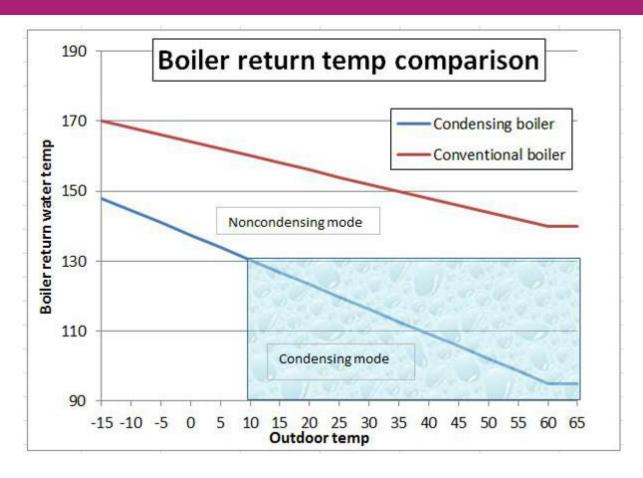




Set or adjust to optimize function and energy efficiency — Use your judgement!

Review Reset Schedules & Setpoints

- 1. HW loop temperature
- 2. CHW loop temperature
- HW loop differential pressure
- CHW loop differential pressure



Set or adjust to optimize function and energy efficiency — Use your judgement!

Sensor Calibration

Check sensor error for critical sensors

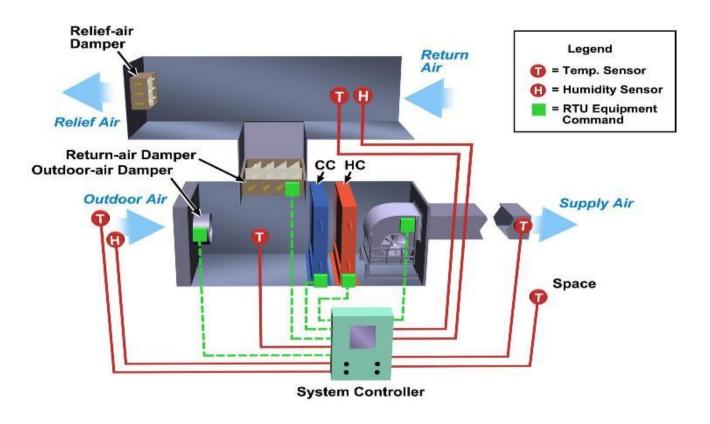
- 1. Outside air temperature
- 2. Discharge air temperature
- 3. HW loop supply & return temperature
- 4. CHW loop supply and return temperature
- 5. CO2 sensors
- 6. Condenser water supply and return temperature





Identify where sensors should be replaced. Adjust or recommend replacement as required.

HVAC Controls Functional Testing



Functionally test all modes of operation

- Occupied
- Unoccupied
- Warm-up
- Over-ride
- Others...

Adjust control sequences as appropriate for current facility requirements

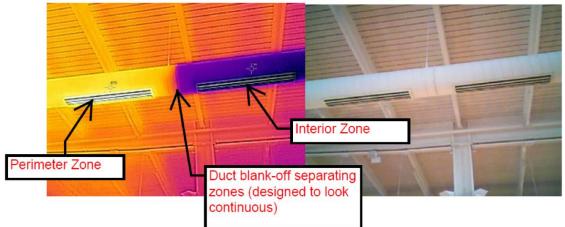
Simultaneous Heating & Cooling

Review HVAC control sequences for unintended instances of heating and cooling

- IR images of coils
- Cooling with perimeter heat
- 4-pipe fan-coils
- Large open spaces with multiple HVAC systems
- Heat/cool lockouts

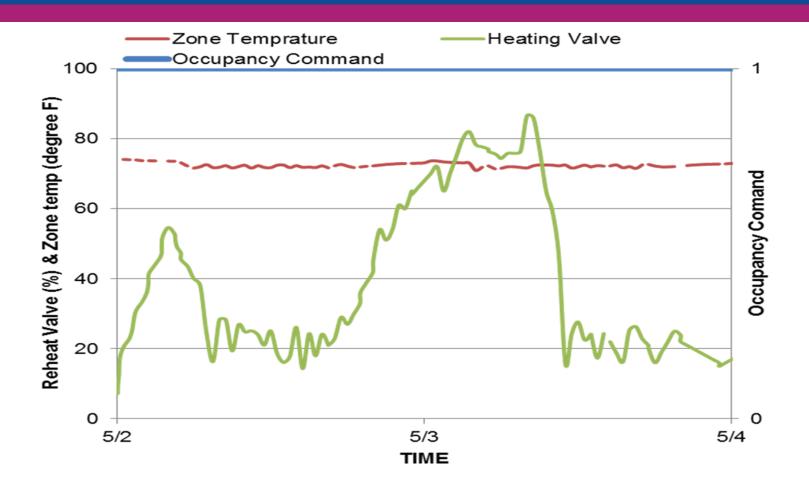


Open Office on Upper Level - adjacent diffusers in heating and cooling



Adjust HVAC control sequences to reduce or eliminate any unintended or inappropriate simultaneous heating & cooling

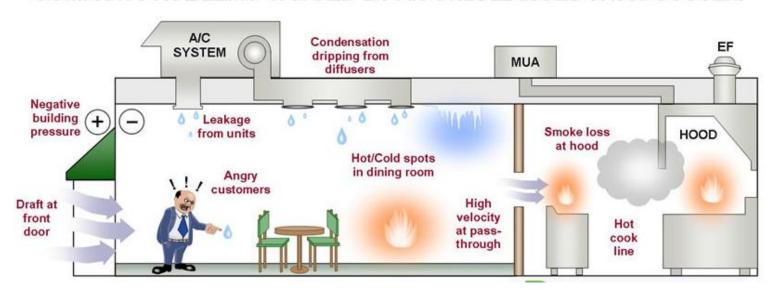
Zone Conditioning: Continuous Reheat and No Schedule



- Zone occupancy schedule missing?
- Reheat valve is active all the time (during unoccupied (night) periods)

Air Balance Issues

COMMON PROBLEMS CAUSED BY AN UNBALANCED HVAC SYSTEM

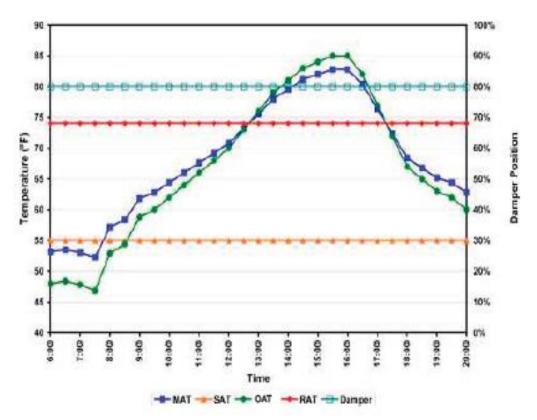


Note any indications of significant air balancing issues.

Voluntary: Recommend re-balancing where significant efficiency or comfort improvements can be achieved

Excessive Ventilation Rates

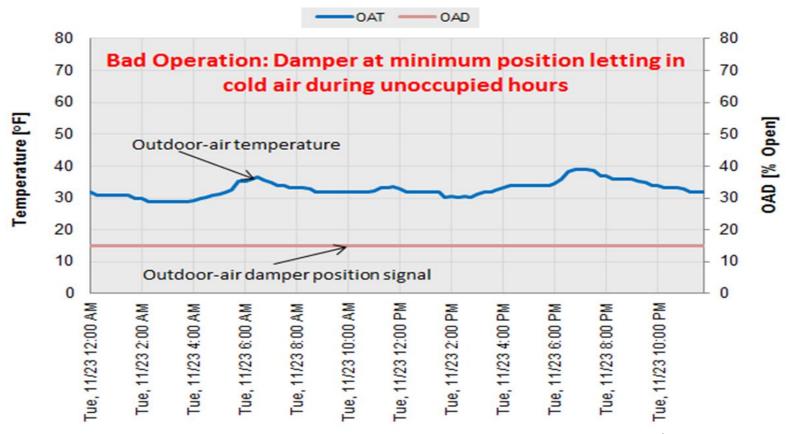
Example trend of MAT, SAT, OAT, RAT & OSA Damper Position



Identify any indications of excessive ventilation rates.

Voluntary: Recommend an analysis of the ventilation system if warranted.

Occupancy Scheduling: Outdoor Air Damper during Unoccupied Hours



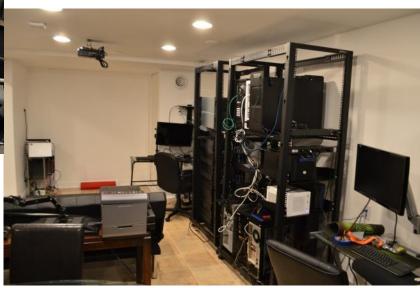
The outdoor-air damper should not open up during morning warm-up/cool-down (unless the weather is appropriate for economizing), and then it should open 30 minutes prior occupancy to flush the building. It should close at the end of the occupied time, and stay closed overnight.

Multi-zone Systems



24/7 dispatch center in an office building

Server Rooms Served by Central HVAC



Identify zones that may be dominating multi-zone system operations. Voluntary: Recommend solutions to isolate these zones.

HVAC Maintenance, Cleaning & Repair

What to look for:

- Dirty filters, ducting, grilles, coils
- Missing or damaged panels/access doors or seals
- Missing or damaged mechanical items (fan motors/blades/belts, pulleys)
- Missing or damaged duct and pipe insulation
- Stuck HVAC dampers
- Equipment at the end of its service life

Three Required Actions: Clean or replace filters, repair damaged equipment, repair/adjust faulty dampers. Can make other voluntary recommendations.



Jammed/Frozen
Damper

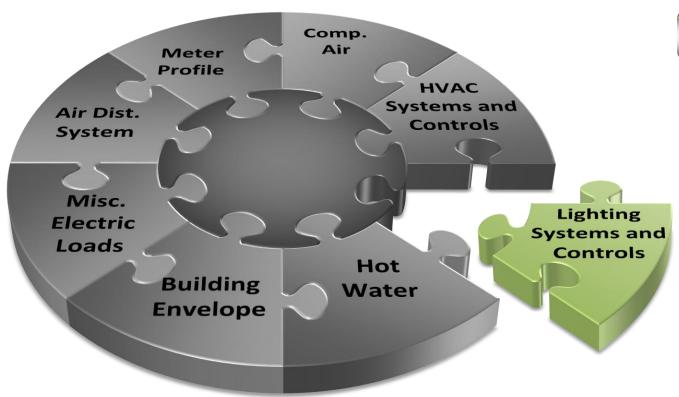


Disconnected Damper



Wired poorly

Building Walk Down: Lighting



Lighting

- Interior Lighting Systems and Controls
- Exterior Lighting
 Systems and Controls

Seattle Building Tune-Ups Rule:

Table 1: 2.a-c

Table 2: 2.a

Tab H on Report

Lighting Levels

- Spot check lighting levels by use type
 - Voluntary: Recommend areas where the lighting power density could be reduced

Activity	Space Types	Recommended Illumination (lux)	Foot Candles (FC)
Public areas with dark surroundings	Parking garage	20 - 50	2-5
Simple orientation for short visits	Lobbies, storage areas, corridors	50 - 100	5-10
Working areas where visual tasks are only occasionally performed	Waiting areas, auditoriums	50 - 150	5-15
Easy Office Work, Classes	Certain offices and classrooms	200-300	20-30
Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories	Certain offices, classrooms, libraries	350-500	35-50
Retail	Supermarkets, Mechanical Workshops	300-800	30-80

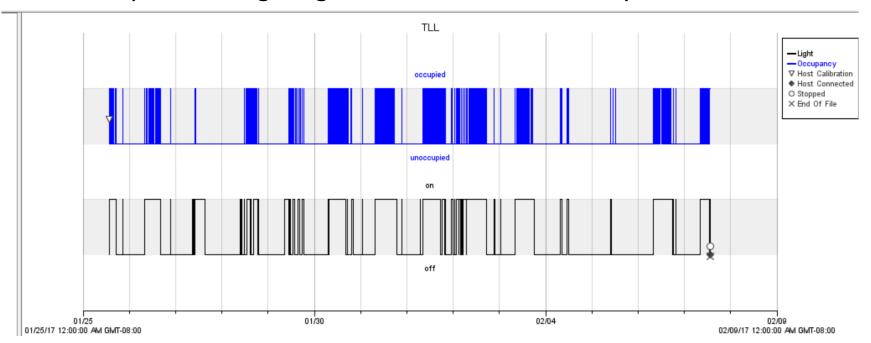


Automatic Lighting Controls

- Verify occupancy/vacancy sensors working correctly (sampling OK)
- Identify areas that could benefit from occupancy sensor or daylight harvesting
- Verify exterior lighting controls function correctly



light/occupancy logger

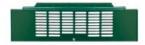


Lighting Control Schedules

- Verify lighting on/off schedules match occupancy. Set or adjust as appropriate.
 - Stand-alone control or BAS interface?
 - Correct time and day?
 - Overrides?
 - Override length?
 - All lights controlled?







Lighting control panel

Lighting Maintenance

- Identify inefficient lighting equipment and recommend replacement if appropriate (voluntary)
 - Incandescent or metal halide fixtures
 - T12 fluorescent fixtures
 - Magnetic ballasts
 - Replace 32-watt T8 lamps with 28 or 25-watt T8 lamps



T-12 lighting

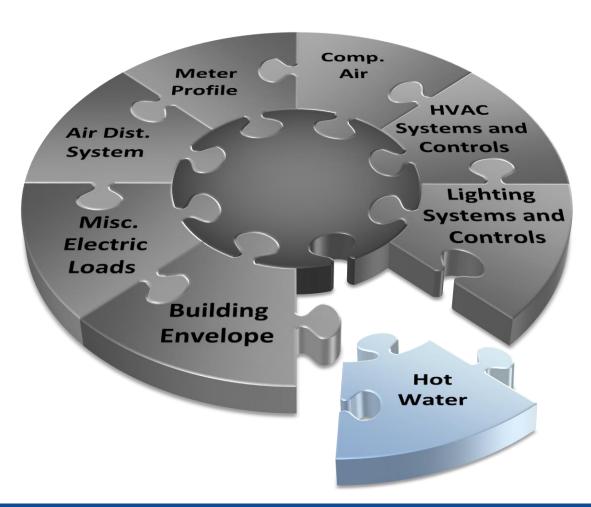


Ballast checker



Replace 32-watt T8 lamps with 28 or 25-watt lamps

Building Walk Down: Domestic Hot Water Systems



Hot Water

- Water temperature
- Recirculation pumps
- Piping Insulation

Seattle Building Tune-Ups Rule:
Table 1: 3.a-b
Table 2: 1.d

Tab I on Report

Domestic Hot Water Systems

- Measure hot water supply temperature
 - Adjust setpoint for occupancy and use if appropriate
 - NOTE: Seattle Plumbing Code 407.3 maximum hot water temperature to public lavatories is 120F
- Review circulation pump controls
 - Set or adjust as appropriate
 - No controls, Integral control or BAS?



No control



Control by BAS



Integral control

Building Walk Down: Water Usage







- Cooling Towers
- Irrigation
- Fixtures

Seattle Building Tune-Ups Rule:

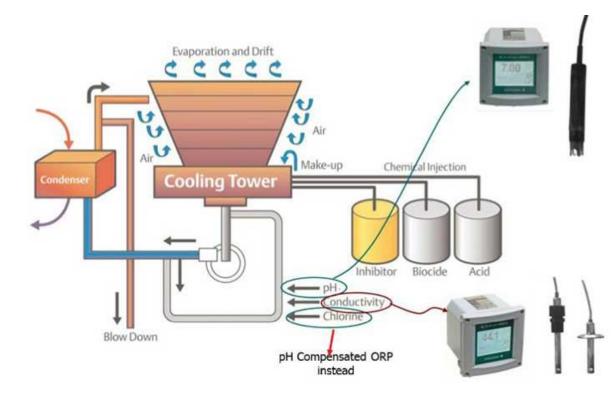
Table 1: 4.a-d

Table 2: 3.a-e

Tab J on Report

Water Usage – Cooling Towers

- Verify conductivity meter used to control blowdown is calibrated and functioning properly (required)
 - Measure sump conductivity
 - Calibrate water treatment controller
 - Leaky blowdown valves
- Recommend repair if required (voluntary)

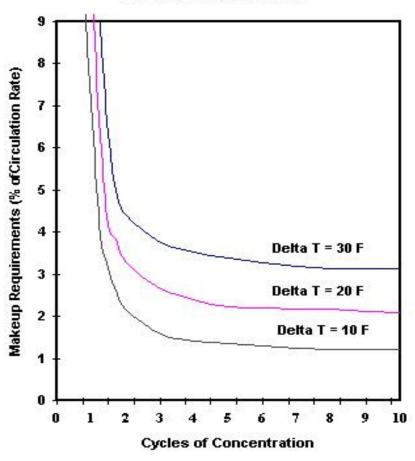


Water Usage – Maintenance, Cleaning & Repair

- Evaluate cooling towers for water leaks and excess water consumption
 - Repair or adjust as appropriate for standard or regular maintenance actions (required)
 - Recommend repairs if scope more than standard maintenance (voluntary)

Cycles of Concentration (COC) is the ratio of the maximum sump conductivity (or Total Dissolved Solids TDS) to the makeup water conductivity/TDS

Effect of Cycles of Concentration on Makeup Requirements



Water Usage – Irrigation Systems

- Irrigated area >500 ft2
 - Review irrigation schedule for improvements (voluntary)
- Verify irrigation sensors are functioning properly (required)
 - Locate rain sensor. Override irrigation zone you can see and activate sensor
 - Test continuity
 - Adjust, calibrate or repair/replace as required



Rain sensor/switch

Water Usage – Water Features

- Review water feature schedules (required)
 - Set to shut-down during night time or unoccupied periods where appropriate



Water Usage – Maintenance, Cleaning & Repair

- Check irrigation system for leaks, overspray, broken heads, plugged nozzles or other operational problems (required)
 - Adjust and repair as appropriate
 - Recommend repair if scope of work more than routine maintenance (voluntary)





Water Usage – Maintenance, Cleaning & Repair

- Check hands free sensor-activated plumbing fixtures for proper operation (voluntary)
 - Recommend repair if scope of work more than routine maintenance (voluntary)
- Check water flow rate for fixtures (voluntary)
 - Recommend low-flow fixture or aerator replacement if appropriate
 - 2015 Seattle Plumbing Code Maximum Water Consumption
 - 0.25 GPM metered public faucets
 - 0.5 GPM public lavatories
 - 2.2 GPM private lavatories
 - 2.5 GPM kitchen faucet
 - 2.5 GPM shower head



Building Walk Down: Envelope



Envelope

- Walk outside & inside
- Doors
- Windows
- Openings
- Shades
- Exterior Plug Loads
- Insulation
- Roof
- Attic and Crawl Spaces
- Seal un-used penetrations in envelope (piping, duct work, etc.)

Seattle Building Tune-Ups Rule:
Table 2: 4.a, 4.b, 4.c

Tab K on Report

Building Envelope Walk Down: Doors and Windows

Focus on the exterior conditions of the building

Door and window type:

- Are the windows operable?
- Are the windows single, double or triple pane?
- Are any windows and outside doors open during the walk down?
- If windows and doors are open, this could indicate a problem related to heating, cooling or ventilation





Building Envelope: Maintenance, Cleaning, Repair

- Check for unsealed penetrations that allow for entry of air or water
- Check for missing weather-stripping at doors & windows
- Check elevator shaft dampers- stuck open or leaky
- Identify uninsulated attic areas or insulation damage
- Identify any significant duct leakage (disconnected ducting or holes)

Recommend repairs if scope of work is more than standard maintenance



Gaps under doorways



Failed roof insulation

QUESTIONS?



Building Renewal: A Roadmap to Deeper Savings

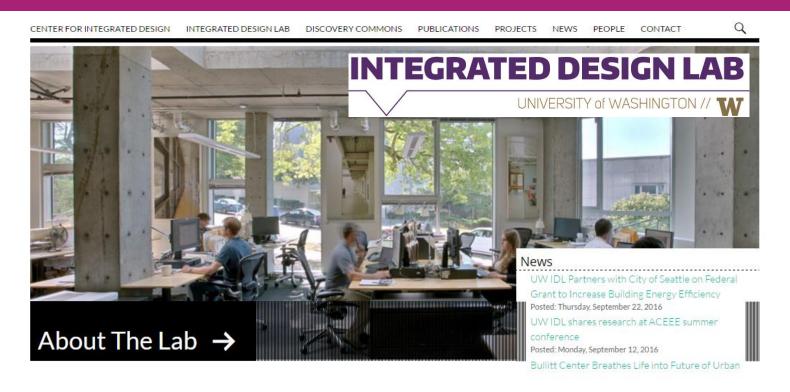
PRESENTED BY: Christopher Meek, AIA, IES Integrated Design Lab

Associate Professor and Director University of Washington Department of Architecture cmeek@uw.edu





SEATTLE BUILDING TUNE-UP ACCELERATOR

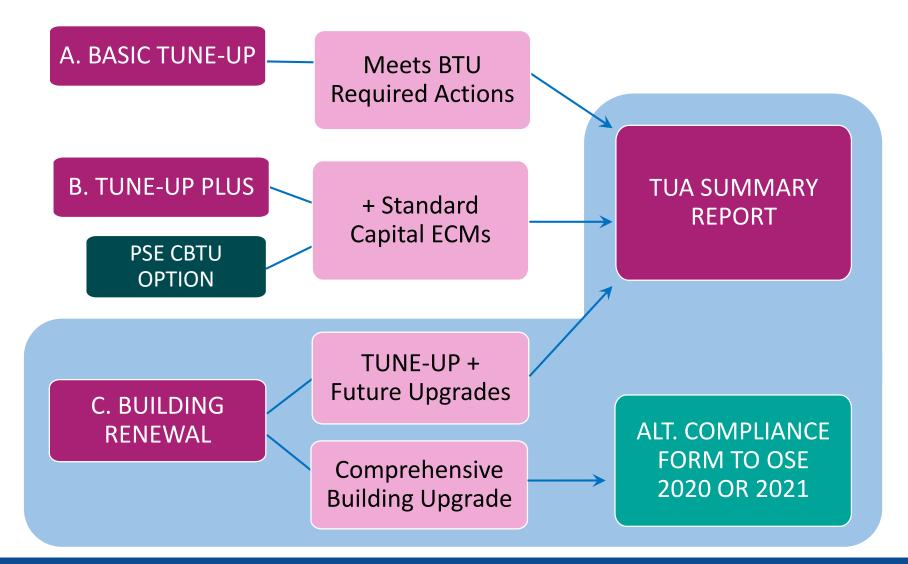




AGENDA

TIME	TOPICS
10 Minutes	What is Building Renewal?
15 Minutes	Opportunities and Technical Approach
10 Minutes	Resources
10 Minutes	SPARK Tool Intro and Demo
5 Minutes	Timeline and Contacts
10 Minutes	Q&A

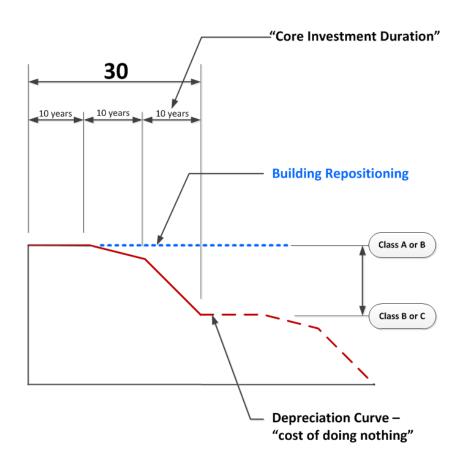
How does Building Renewal fit into the TUA?



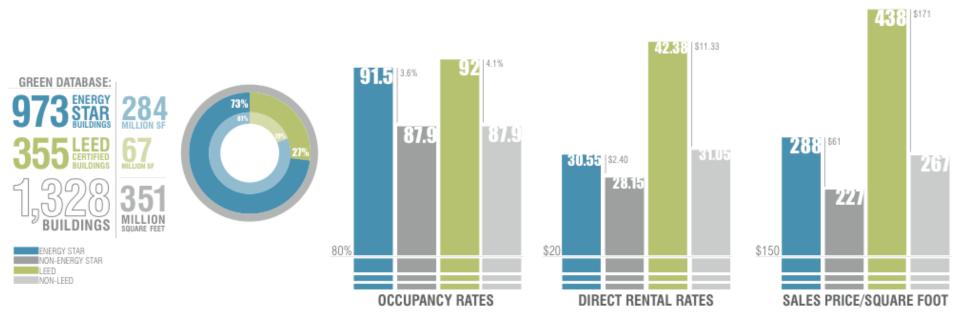
"A customized technical approach for building modernization that significantly improves a building's energy performance, revitalizes its market or operational position, and increases asset value."

Adds Value Beyond Energy Savings:

- Investments can be aligned with the existing building life cycle to build upon and reinforce each other
- Integrated measure package mapped out across a multi-year investment horizon to improve asset value



Increases asset value/economic performance



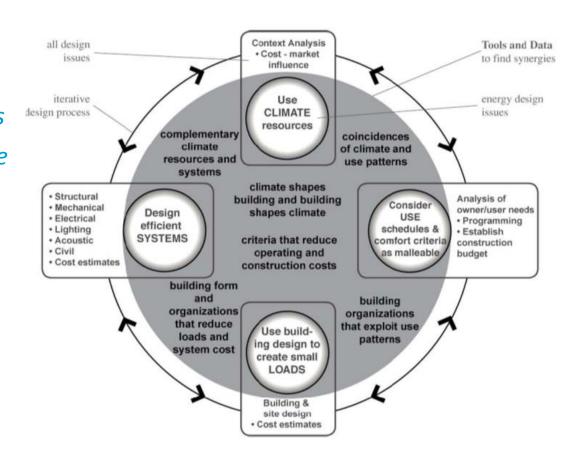
http://www.costar.com/uploadedFiles/Partners/CoStar-Green-Study.pdf

Opportunities: Leverage Points for BR

- Significant capital investments planned
- Major equipment at or near end-of-service life
- Building significantly under-performing the market
- Anticipated change of use
- New major tenant
- Planned future envelope/roof repairs or replacement
- Outdated systems (e.g. Lighting, HVAC)
- Considering aesthetic upgrade
- Energy use significantly higher than peer buildings

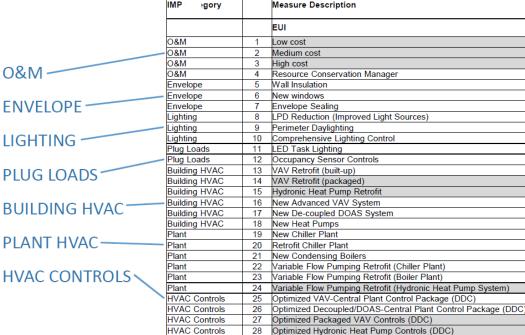
The whole is greater than the sum of its parts...

Integrated design synthesizes climate, use, loads and systems resulting in a more comfortable and productive interior environment, and a building that is significantly more energy-efficient.



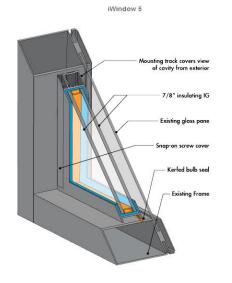
Identify Key Improvement Opportunities

Integrated Measure Packages
provide a suite of targeted energy
efficiency measures that align
investments in the building with
deeper energy savings goals.



Building Renewal Measures: Load Reduction

- Envelope/Glazing
- Lighting Systems
- Plug load/Process load management
- Tenant Engagement



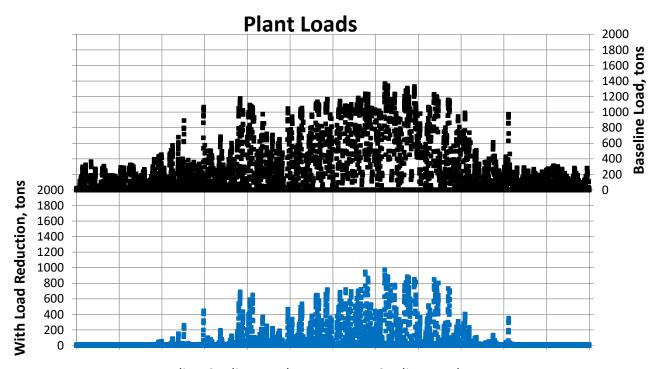






Building Renewal Measures: Efficient Systems

- Building/Suite-Level HVAC
- Central Plant HVAC



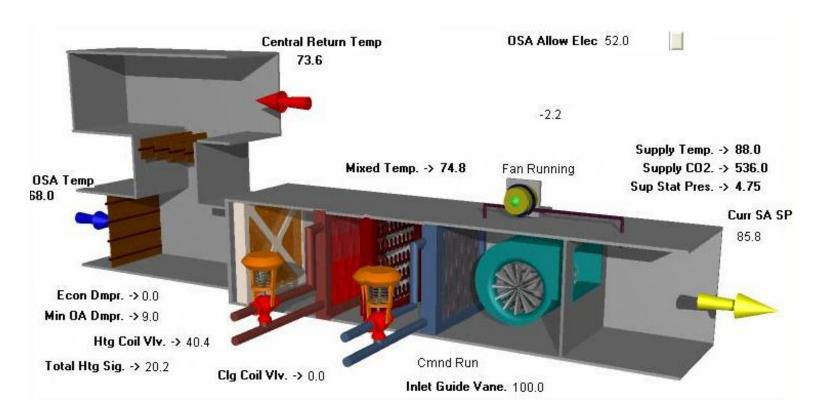




Baseline Cooling Load, tonsIMP Cooling Load, tons

Building Renewal Measures: Controls Improvements

Controls Implementation/Upgrade



Concept-Level Phasing

Develop Implementation Sequence and/or Timeline

		2018										2019									2020										
Measure	J	F	М	Α	М	J	J	Α	S	0	N	D	J	F	М	Α	М	J	J	Α	S	0	N	D	J	F	М	Α	М	J	J
Tune Up																															
Tenant Load Initative/RCM																															
Task Lights/Plug Load Controls																1															
Envelope Sealing												•		V X																	
Secondary Window System										1			M	•																	
Lighting Upgrade																															
Perimeter Induction System VFDs																															
VAV Upgrade										7																					
Variable Flow Heat Rejection																															
Direct Digital Control																															

INTEGRATED DESIGN LAB

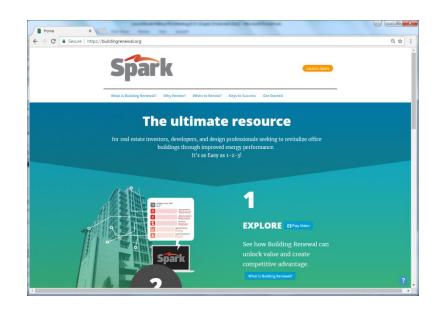
UNIVERSITY of WASHINGTON // W

The University of Washington's Integrated Design Lab will provide technical assistance to owners and service providers as they work w/ consultants on engineering design, permit process, utility incentives and contractor selection.

Resources exist for approximately **25 participant buildings** pursuing deeper energy savings through building renewal at three levels of project engagement.

Level 1 (+/- 25 Buildings) – IDL will provide best-practices recommendations, and where appropriate, SPARK Toolderived measure packages

- Document areas for improvement
- Best practices recommendations
- Spark Tool assessment and report





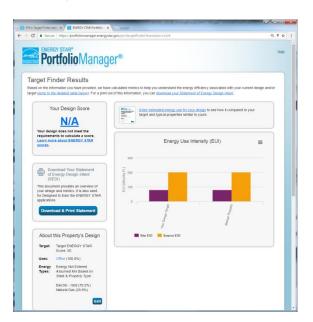
Level 2 (+/- 15 Buildings) – Level 1 activities and **walk-through** with Vendor/Building Owner and technical recommendations. In collaboration with OSE and project Vendors, UW IDL will provide, supplemental technical assistance which may include:

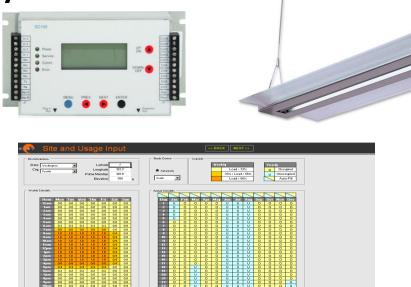
- Setting performance goals
- Implementation process
- System integration recommendations
- Efficient building envelope
- Efficient electric lighting
- Efficient mechanical HVAC systems
- Passive systems integration



Level 2 (+/- 15 Buildings) Examples of Activities

Specific measure analysis:





Goal Setting/Lighting/Controls Retrofit Evaluation/Envelope upgrades



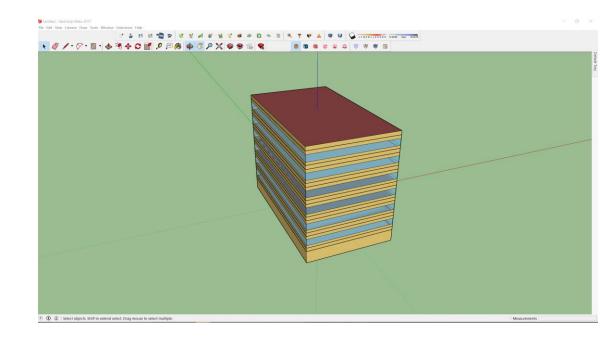
Level 3 (+/- 5 Buildings) – Level 2 activities plus Technical Assistance including **simulation-based analysis and recommendations**. In collaboration with OSE and project Vendors, UW IDL will provide, as time and resources permit, project-specific analytical assistance including:

- Climate and site analysis
- Demonstration of thermal and visual criteria
- Daylight and electric lighting simulation modeling
- Energy simulation modeling
- System integration analysis
- Establishment of performance verification methods



Level 3 (+/- 5 Buildings) **Detailed whole building energy analysis including unique EEMs tailored to specific project opportunities**

Asset Score simulation includes Open Studio Model that can be modified using Open Studio, EnergyPlus, and/or other interfaces to refine analysis of possible measures.



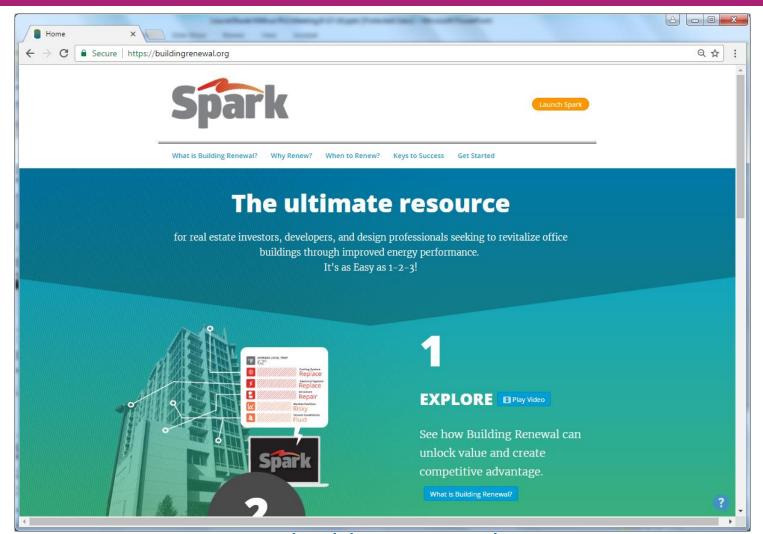
Building Renewal: Action Items...

Contact IDL or OSE if you see Building Renewal opportunities:

- Owner/service provider interested in exploring building renewal alternatives at no cost
- Any office building free confidential SPARK Analysis by IDL
- Owner planning to replace a major system/component and would like to consider Building Renewal alternatives
- Owner considering major renovation/tenant improvement
- Complex/larger/unique building that would benefit from modeling multiple scenarios

Resources will be distributed to projects with in consultation with and approval by OSE

SPARK Tool



www.buildingrenewal.org

SPARK Tool: Target

Built on a framework that can apply to multiple project types

Developed for non-owner occupied commercial leased office buildings over 20,000 SF

<u>Tool users</u>: Professionals tasked with planning, designing or implementing building renovation projects

Tool report: Targeting building investors and owners

SPARK Tool



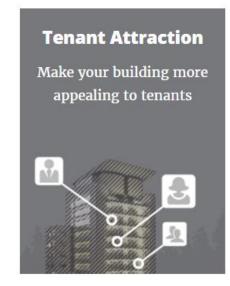
Tool Objectives

- 1. Inform and inspire investigation of building renewal
- 2. Assess technical project potential for a specific building
- 3. Estimate the <u>total value</u> of the investment

SPARK Tool: Non-Energy Benefits









Project Identification/Suitability



https://buildingrenewal.org/

Developed by BetterBricks

- Uses EnergyPlus seed models to simulate energy performance
- Incorporates business case
- Exports report and technical appendix

QuickScreen

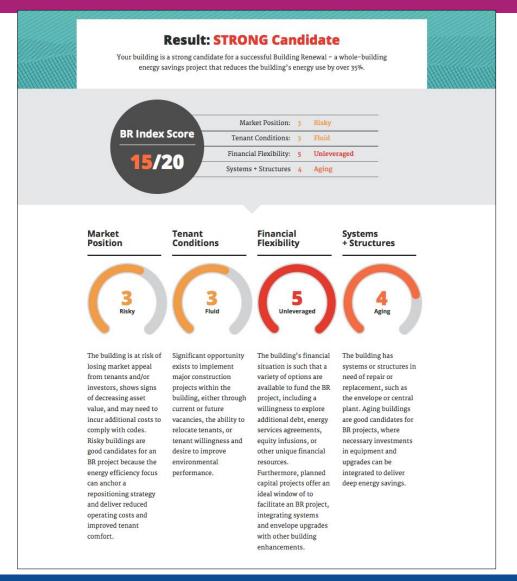
Rapidly diagnosing market, financial, tenant and technical factors, QuickScreen will deliver a short report based on your responses. The summary report characterizes your building as a "Strong", "Potential" or "Limited" as a candidate for a Building Renewal project.

The higher your score the more you should consider using Spark to investigate Building Renewal for your building.



17 Questions to determine if appropriate for further evaluation

SPARK Tool: Quick Screen Report



Input Building Information



Catagory	Asset Score - Short Form	Asset Score - long form	Spark - Building Renewal
Category	Form	TORM	Kenewai
General Information			
Name and address			
Year Completed			
Gross Floor Area			
Rentable Square footage			
# of Floors			
Building Use Type			
Portfolio Manager Score			
Planned modernization or renovation			
Construction			
Roof Type			
Roof Thermal Properties			
Cool Roof (yes/no)			
Floor Type			
Floor Thermal Properties			
Slab on grade insulation			
Wall Type			
Wall Thermal Properties			
Window Framing Type			
Window Glass Type			
Window U-value			
Window SHGC			
Window VT			
# of Windows			
Skylight Type			
Skylight U-value			
Skylight SHGC			
Skylight VT			
Skylight Layout			
Envelope been resealed in last 15 years			



Categories

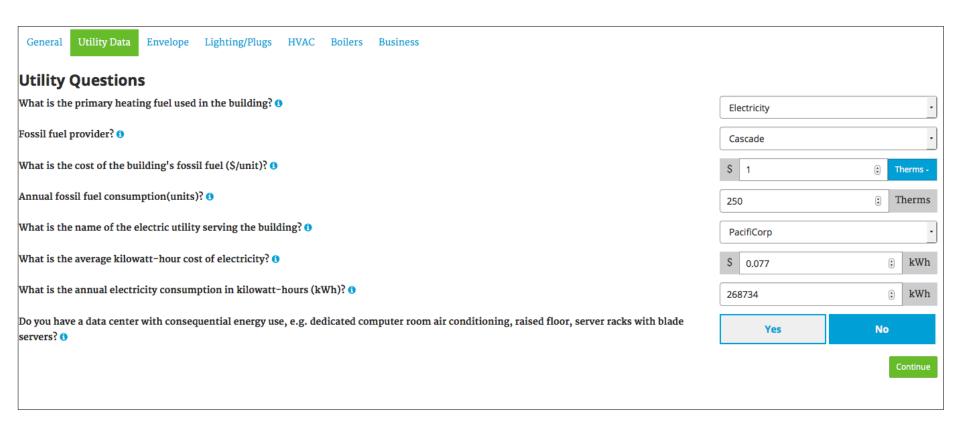
- General
- Utility Data
- Envelope
- Lighting/Plugs
- Chillers
- Boilers
- VAV
- Business

Asset Score

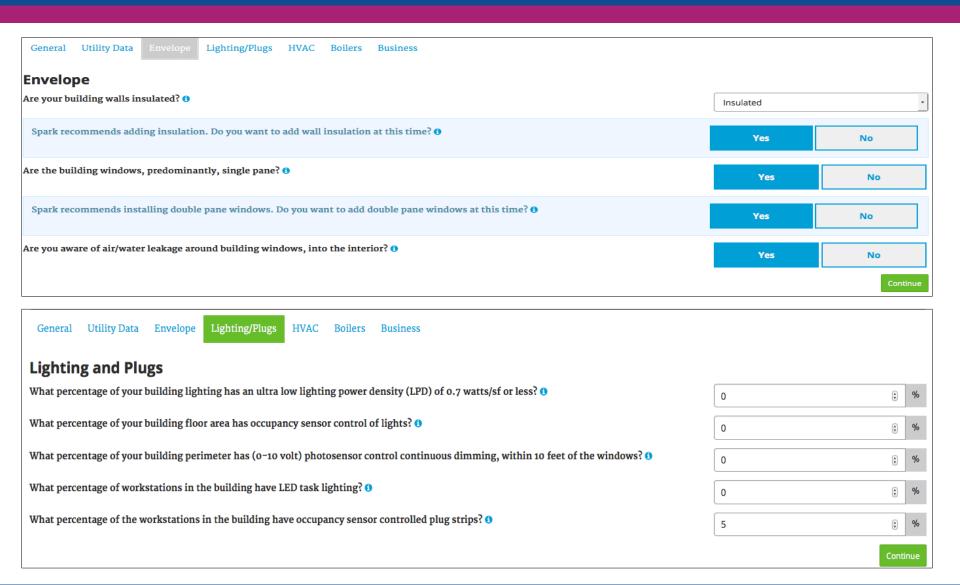
Categories

- Geometry
- Use Types
- Construction
- Lighting
- Heating & Cooling
- Water Heaters
- Operations
- Business

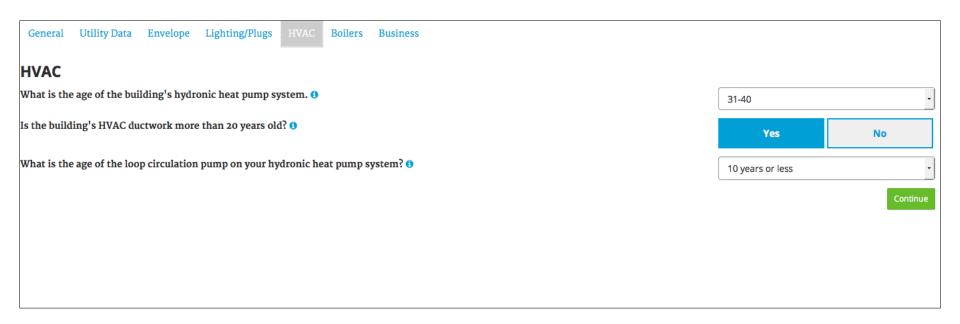
Inputs – Energy Data



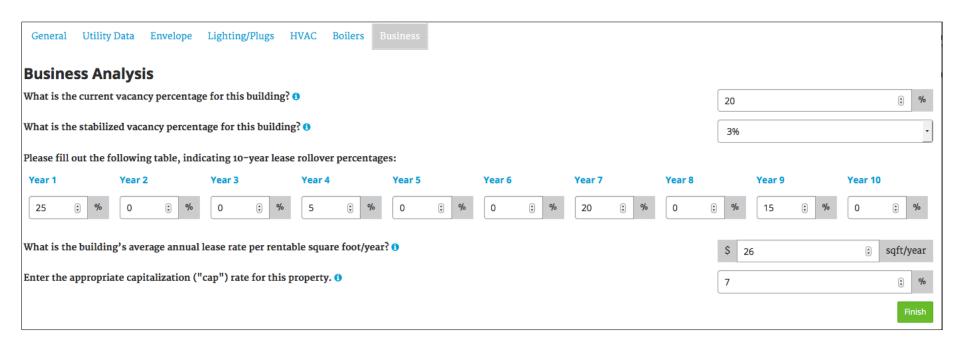
Inputs – Major Systems



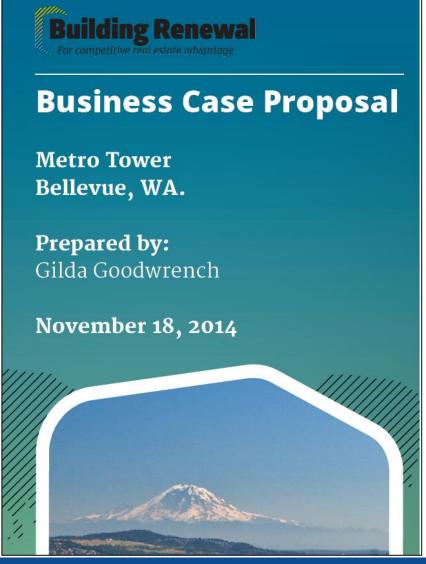
Inputs – Major Systems



Inputs – Business Analysis



Assessment Report - Opportunities



BUILDING RENEWAL

THE OPPORTUNITY

By implementing the complete package of energy efficiency measures recommended in this report, the Metro Tower has an opportunity to undergo a modernization that will significantly improve its energy performance, revitalize its competitive market position and increase asset value. The proposed project scope package of measures will result in total estimated energy savings of 41% at an estimated return of 15.6%.

Energy efficiency improvements and economic indicators are presented as if the entire package of energy efficiency measures is completed at the same time and as part of the same integrated, project scope. Reducing heating and cooling loads first optimizes HVAC system sizing and energy and economic performance. From a practical perspective, we understand that the proposed package of measures may need to be phased as opportunities and tenant rollover permit. The aim of this Building Renewal proposal is to provide an integrated package of measures with suggested measure sequencing to optimize results and provide the basis for a building roadmap to significantly higher energy performance.

ENERGY SAVINGS



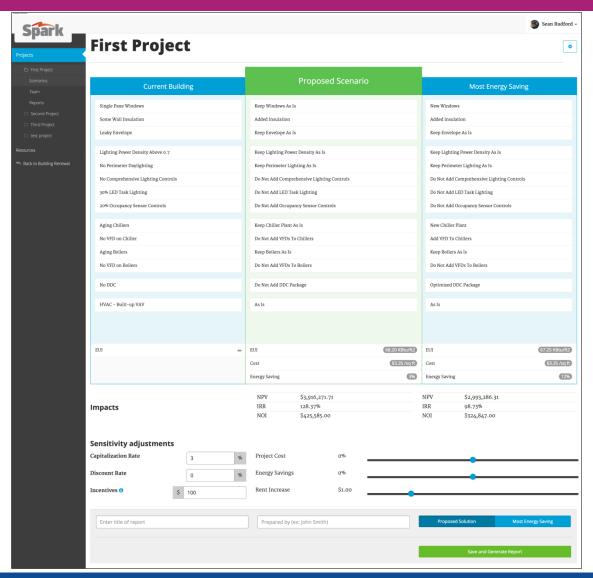
Energy Use: • 41%

Energy Cost: • 33%

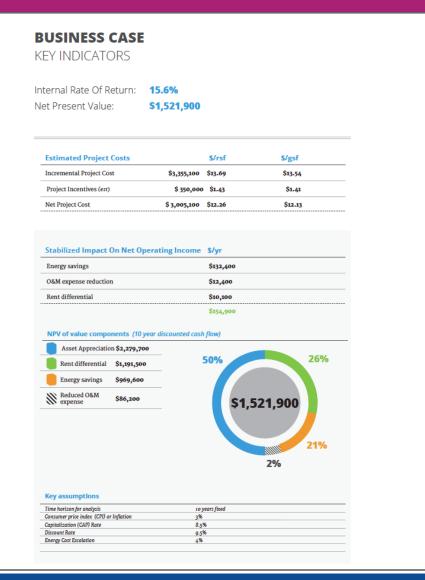
Annual Energy Savings: \$132,400

Building Renewal Report | 2

Comparative Analysis



Assessment Report – Key Indicators Excerpt



Assessment Report – Project Scope Excerpt

PROJECT SCOPE

PACKAGE OF MEASURES

The following project scope energy efficiency measures have been envisioned as an integrated, bundled solution, to achieve 41% energy savings

New windows

Replace old, inefficient window assemblies with newer double pane units offering better thermal performance.

Envelope sealing

Reduce air leakage through the building enclosure

LPD reduction

Reduce lighting load by delivering lower ambient lighting and high quality task lighting at each workstation.

Comprehensive control (daylight and vacancy controls throughout)

Reduce and/or turn off electric lights when unnecessary

New chiller plant

Install a new high efficiency chiller (or chillers), with efficiency improvement of 20% to 30% compared to the existing chillers.

New condensing boilers

Replace aging boilers; improve plant part load operation by installing modulating boilers and/or modular boiler plants that can effectively operate at low load conditions, without excessive cycling.

Variable flow pumping retrofit - chiller plant

Pump replacement offers the opportunity to improve the mechanical efficiency of the pumps. This measure applies primarily to chilled water pumping systems but can also be applied to condenser water systems in some plants.

Variable flow pumping retrofit - boiler plant

Upgrade of existing constant flow heating water systems to energy-saving variable flow can involve some or all of the following: new piping, new pumps and motors, valve upgrade or replacement, VFD installation, and new controls.

Optimized VAV-central plant DDC package

Optimize existing controls, or Install a direct digital control system that controls all elements of the HVAC system and is tightly scheduled for building occupancy and other exterior influences. The system should not only execute control functions, but also collect and archive relevant building performance data for use in M&V activities.

Technical Addendum

A technical addendum can be downloaded from Spark, with descriptions of each energy efficiency measure, in sufficient detail to understand the measure intent and performance assumptions. These measure descriptions also discuss certain implementation issues and construction options.

SPARK Tool: Testimonial Video



https://www.youtube.com/watch?v=biURp1P1jl8

Resources and Contacts

<u>University of Washington Integrated Design Lab (UW IDL)</u>

- Technical Support Building Renewal
- Recommended Opportunities
- Targeted Data Evaluation
- Targeted Simulation Support
- SPARK Tool Assistance

Contact:

Christopher Meek: cmeek@uw.edu

UW Integrated Design Lab

206-616-6566

http://www.cidseattle.com/idl/

Project Goals: Refinement and Scalability

- UW IDL will document implementation of Building Renewal progress though June 2019
- Our aim is to better understand opportunities and barriers for implementation of deeper savings and building renewal concepts
- Our intent is documenting project specific services delivered, outcomes, and lessons learned, to share with service providers and the City of Seattle OSE
- Long term owner engagement and assistance will be developed through the SBC and IDL

UTILITY INCENTIVE PROGRAMS

SEATTLE CITY LIGHT



Training Wrap Up & Next Steps

Next Steps

- Please fill out the Evaluation Form
- Service Provider Agreement
- Help sign up buildings!



EVALUATION FORM

Helpdesk Support from SBC

Help Desk Hotline 206-800-7211

Help Desk Email accelerator@seattle.gov



THANK YOU!

